State of Oregon
Department of Environmental Quality

United States Environmental Protection Agency

PORTLAND HARBOR JOINT SOURCE CONTROL STRATEGY

FINAL

DECEMBER 2005

This document provides information and technical assistance to the public and employees of the Oregon Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency (EPA) regarding the agencies cleanup programs. The information contained in this document should be interpreted and used in a manner that is fully consistent with the State's and EPA's environmental cleanup laws and implementing rules. This document does not constitute rulemaking by the Oregon Environmental Quality Commission or by EPA, and may not be relied upon to create a right or benefit, substantive or procedural, enforceable in law or equity, by any person, including the DEQ or EPA. DEQ or EPA may take action at variance with this document.

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Joint Source Control Strategy Principles

The following bullets present the Oregon Department of Environmental Quality's (DEQ) and U.S. Environmental Protection Agency's (EPA) underlying principles of the Joint Source Control Strategy (JSCS):

- The JSCS represents a framework for making upland source control decisions at the Portland Harbor Superfund Site. All source control determinations are site specific based on facts determined through upland remedial investigations and the Portland Harbor Remedial Investigation and Feasibility Study (RI/FS).
- The overarching goal of the JSCS is to identify, evaluate, and control sources of contamination that may reach the Willamette River, in a manner consistent with the objectives and schedule of the Portland Harbor RI/FS. Upland source control should be completed to the extent practicable prior to sediment cleanup in the Portland Harbor Superfund Site.
- Upland sources of contamination that adversely impact or have the potential to adversely impact the Willamette River, within the Portland Harbor Superfund Site, should be addressed in accordance with the MOU[1] and the JSCS.
- DEQ is implementing a timeline by which, unless an upland facility is recalcitrant, the goal of screening, identifying, and evaluating sites needing source control should be complete by the time EPA issues the Portland Harbor Record of Decision (ROD).
- Uncontrolled upland sources of contamination in the Portland Harbor Superfund Site may be considered for CERCLA[2] cleanup in an EPA Portland Harbor Record of Decision (ROD).
- The Upland Potentially Responsible Party (PRP) is responsible for upland source control and the focus of their work should be to identify, evaluate, and control or eliminate upland sources of contamination to the Willamette River. It is the Upland PRP's responsibility to collect in-water data if the data are needed to determine if there is a current or potentially complete contaminant migration pathway to the river; make source control decisions; or design and implement source control measures.
- The Lower Willamette Group (LWG)[3] is responsible for characterizing and evaluating the impacts of the off-shore contamination from upland sources to the river through the Portland Harbor remedial investigation/feasibility study (RI/FS).
- Source Control Screening Level Values (SLVs) used in this JSCS to assess potential threats to the Willamette River from upland sources include medium-specific (*e.g.*, water,

[1] MOU – Memorandum of Understanding between EPA, DEQ, and other governmental parties, dated February 8, 2001.

[2] CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act commonly known as Superfund, was enacted by Congress on December 11, 1980 (U.S. Code – Title 42 Chapter 103). CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) on October 17, 1986.

[3] EPA entered into an Administrative Order on Consent (AOC) with a group of responsible parties who are members of the Lower Willamette Group (LWG).

soil) and chemical-specific standards or guidelines. SLVs may be used in two ways: first, they will be used in screening level risk assessments and second, they may be used as helpful comparisons to prioritize source control tasks. The EPA Portland Harbor ROD(s) will establish contaminant specific cleanup levels based on identified applicable or relevant and appropriate requirements (ARARs) or risk-based levels.

- Upland sources of contamination threatening the river will be screened against the SLVs. Exceedance of an SLV does not necessarily indicate the upland source of contamination poses an unacceptable risk to human health or the environment, but does require further consideration of the need for source control using a weight-of-evidence evaluation. Screening results and consideration of other factors identified in Section 4.4 will be used by DEQ and EPA to prioritize the sites as high, medium, and low priority. The initial point of compliance for screening should be near the point of discharge[4] to the river.
- A high-priority site will typically be defined as having an ongoing source of contamination that significantly exceeds an SLV at the point of discharge to the river or represent an imminent and substantial threat to human health or the environment, based on a consideration of site specific information. High-priority sites identified by the DEQ and EPA must move forward with aggressive evaluation of pathway specific source control measures and source control implementation as deemed necessary by DEQ and EPA.
- A medium-priority site will typically be defined as exceeding an SLV at the point of discharge to the river. Medium priority sites will undergo a weight-of-evidence evaluation, and upland information may be supplemented by in-water data during the process. DEQ and EPA will then determine if source control is necessary.
- A low-priority site will typically be defined as not exceeding appropriate SLV at the point of discharge to the river. No further source control efforts will be required at this time for low-priority sites.
- An excluded site is defined as having no contaminant source and/or no current or reasonably likely complete contaminant pathway to the river.
- Consistent with the February 2001 MOU, the DEQ is lead agency for the identification, evaluation, and control of upland contaminant sources to the Portland Harbor Superfund Site. The DEQ will provide opportunity for EPA and its partners to offer input on source control documents, as needed. The JSCS identifies the source control decisions that DEQ will submit to EPA and its partners for review and comment.
- Source control evaluations and implementation of source control measures must be integrated into an overall project schedule. DEQ will keep EPA and its partners apprised of source control progress through tracking spreadsheets and periodic meetings.
- Upland source control and in-water cleanup actions should be integrated, where appropriate.

[4] "Point of Discharge" – screening locations are defined by media in Section 5 of this document. Representative sampling points for site prioritization and source control decisions should be defined appropriately for each contaminant migration pathway.

- Information contained in the EPA Portland Harbor ROD(s) will help confirm whether upland sources have been controlled sufficiently to ensure protection of human health and the environment.

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PORTLAND HARBOR JOINT SOURCE CONTROL STRATEGY

Final

TABLE OF CONTENTS

Tables

Figures

Appendices

LIST OF ACRONYMS

ACG	Analytical concentration goal
AOC:	Administrative Order on Consent
ARAR:	Applicable or relevant and appropriate requirements
AWQC:	Ambient Water Quality Criteria
BMP:	Best Management Practice
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act (also know as "Superfund")
CLP:	Contract Laboratory Program
COI:	Chemicals (or contaminants) of interest
COPC:	Chemicals (or contaminants) of potential concern
CSM:	Conceptual site model
CSO:	Combined sewer overflow
DEQ:	Oregon Department of Environmental Quality
DNAPL:	Dense non-aqueous phase liquid
ECSI:	Environmental Cleanup Site Information database
EE/CA:	Engineering Evaluation/Cost Analysis
EPA:	U.S. Environmental Protection Agency
FFS:	Focused feasibility study
FS:	Feasibility Study
FSP:	Field Sampling Plan
g/day:	Grams per day
IRM:	Interim remedial measure
ISA:	Initial Study Area
JSCS:	Joint Source Control Strategy
K_{oc}:	Organic carbon-normalized soil-water partition coefficient
K_{ow}:	Octanol-water partition coefficient
LCV:	Lowest chronic value
LNAPL:	Light non-aqueous phase liquid
LWG:	Lower Willamette Group
MCL:	Maximum contaminant level

LIST OF ACRONYMS
(Continued)

mg/kg: Milligrams per kilogram

mg/L: Milligrams per liter

MOU: Memorandum of Understanding

MRL: Method Reporting Limit

NAPL: Non-aqueous phase liquid

NCP: National Oil and Hazardous Substances Pollution Contingency Plan

NFA: No Further Action

NPDES: National Pollution Discharge Elimination System

NPL: National Priorities List

NRWQC: National Recommended Water Quality Criteria

OAR: Oregon Administrative Rules

ORNL: Oak Ridge National Laboratory

ORS: Oregon Revised Statute

PA: Preliminary Assessment

PAH: Polynuclear aromatic hydrocarbons

PCB: Polychlorinated biphenyls

PEC: Probable effects concentration

PQL: Practical Quantification Limit

PRG: Preliminary remediation goal

PRP: Potentially responsible party

RCRA: Resource Conservation and Recovery Act

RI: Remedial Investigation

RI/FS: Remedial Investigation and Feasibility Study

RM: River mile

ROD: Record of Decision

SARA: Superfund Amendments and Reauthorization Act

SI: Site Investigation

SLV: Screening Level Value

LIST OF ACRONYMS
(Continued)

TCT: Technical Coordination Team

TEC: Threshold Effects Concentration

μg/L: Micrograms per liter

VOC: Volatile organic compound

XPA: Expanded preliminary assessment

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Section 1 Introduction

1.1 Joint Source Control Strategy Objectives

On December 1, 2000, a section of the Willamette River within the City of Portland, the Portland Harbor, was added to the Superfund National Priority List (NPL). The Portland Harbor cleanup includes upland and in-water contamination. In February 2001, Oregon Department of Environmental Quality (DEQ), United States Environmental Protection Agency (EPA), and other governmental parties signed a Memorandum of Understanding (MOU) that provided a framework for coordination and cooperation in the management of the Portland Harbor Superfund Site to optimize federal, state, tribal, and trustee expertise and available resources.

Under the February 2001 MOU, it was agreed that the DEQ, using state cleanup authority, has lead technical and legal responsibility for the upland contamination and for coordinating with the EPA on upland contamination which may impact the river (*e.g.*, sediment, groundwater, transition zone water, and/or surface water). EPA, using federal Superfund authorities, has lead technical and legal responsibility for in-water contamination. In order to coordinate upland source control, the MOU specifies that DEQ and EPA will jointly *develop a source control strategy that defines a process for identifying and controlling potential sources of contamination* threatening the river.

The **overarching goal** of the Portland Harbor Joint Source Control Strategy (JSCS) is to identify, evaluate, and control sources of contamination that may impact the Willamette River in a manner that is consistent with the objectives and schedule for the Portland Harbor remedial investigation and feasibility study (RI/FS). Timely upland source control is necessary so that cleanup of the river can proceed without risk of significant recontamination.

To achieve this overarching goal, the **objectives** of the JSCS are:

1) Outline the process DEQ will use to identify upland sources of contamination threatening the river.

2) Provide screening level values (SLVs) or standards to:
   A) Screen and prioritize upland sources of contamination to identify those that require further evaluation;
   B) Identify those sites that may pose a threat to the river (and may require source control efforts); and
   C) Assist in developing preliminary cleanup goals for source control measures.

3) Establish the process to share data from the upland source control work and the in-water Portland Harbor RI/FS data to ensure more informed upland source control decisions and in-water remedial decisions.

4) Present the process to prioritize upland sources by magnitude of the threat and/or degree of impact on the river and recontamination potential including:
   A) High priority sources, which must move forward with aggressive source control measures without delay;

B) Medium priority sources for which additional evaluation (*e.g.*, additional sampling, modeling) is required to determine if source control is needed and prioritize the implementation of source control measures; and
C) Low priority sources for which source control measures will not be required unless determined necessary by the Portland Harbor RI/FS or ROD(s).

5) Present the approach for evaluating storm water discharges to the river. Evaluating storm water discharges are considered a high priority for the JSCS. DEQ has been working with the City of Portland to investigate and control sources to municipal lines and DEQ plans to continue investigating storm water discharges in early 2006 and 2007 to allow completion of upland source control decisions and to provide needed data to the in-water RI/FS.

6) Provide a schedule for control of upland sources and the process DEQ will use to ensure source control activities comply with the anticipated EPA Portland Harbor Record of Decision (ROD) schedule.

7) Provide a quarterly milestone reporting process that both DEQ and EPA can use to measure source control status and to provide a process for integrating and/or evaluating upland DEQ investigations and remedial actions consistent with the Portland Harbor RI/FS.

It is also important to acknowledge that once the in-water EPA Portland Harbor ROD(s) and cleanup goals are established by EPA, upland source control decisions will need to be reviewed by DEQ and EPA for protectiveness, and to determine if additional cleanup may be required.

1.2 Document Organization

Section 1: Introduction. This section presents the objectives of the Joint Source Control Strategy and describes the organization of the strategy.

Section 2: Background. This section provides a description of the background of the Portland Harbor project, the regulatory framework for the project, the roles and responsibilities of DEQ and EPA, and coordination of the upland investigations and source control measures with the in-water RI/FS.

Section 3: Screening Level Values. This section presents the Screening Level Values (SLVs). Contaminant concentrations representing upland sources threatening the river should be compared to SLVs to help DEQ decide whether source control measures will be required.

Section 4: Source Control Decision Process. This section presents how upland source control decisions will be made and how source control decisions will be prioritized.

Section 5: Source Control Screening. This section describes upland source control screening in detail for each significant contaminant migration pathway including soil, groundwater, and storm water.

Section 6: Upland Source Control Schedule. The section presents a general schedule for completion of upland source control identification, evaluation, and control activities and a brief description of how DEQ will use its regulatory authority to ensure source control activities comply with the schedule.

Section 7: Source Control Documentation and Tracking. This section describes the process DEQ will use for tracking and reporting milestone measure source control status to EPA and its partners.

Section 8: References. This section provides both specific references cited in the Joint Source Control Strategy and general references that may be useful in the making source control decisions.

Appendix A: Regulatory Framework, Standards, and Criteria. This appendix presents an overview of the regulatory framework for upland investigations and includes a partial list of local, state, and federal regulations that may be applicable to upland source control decisions. This list should <u>not</u> be considered complete or comprehensive and is presented for informational purposes only.

Appendix B: DEQ Identification of Potential Upland Contaminant Sources. This appendix presents DEQ's process for identifying and evaluating potential upland sources of contamination to the Willamette River. This appendix is provided for information purposes only.

Appendix C: DEQ Characterization of Potential Upland Contaminant Sources. This appendix presents DEQ's process for characterizing potential upland contaminant sources and potential considerations for determining if characterization is complete and assessing if a contaminant migration pathway from an upland source to the river exists. This appendix is provided for DEQ project managers and for general information only and focuses on groundwater and storm water migration pathways.

Appendix D: **Framework for Portland Harbor Storm Water Screening Evaluations.** This appendix presents DEQ's guidance for sampling and characterizing upland catch basin sediment and storm water.

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Section 2 Background

This section briefly describes the project background and the site description. It also references to documents that describes the types of contaminants found in the harbor and potential upland sites, types of sources of contamination threatening the river, and contaminant transport.

2.1 Project Background

On December 1, 2000, a section of the Willamette River within the City of Portland was added to the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, "Superfund") and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Initial Study Area (ISA) for this site, as defined in the Administrative Order on Consent (AOC), is a stretch of the river that extends approximately six miles from River Mile (RM) 3.5 to RM 9.2, as shown on Figure 2-1[1]. EPA will define the boundaries of the Superfund Site in the EPA Portland Harbor ROD(s).

2.2 Site Description

Portland Harbor is an 11.6-mile reach of the Lower Willamette River between downtown Portland and the confluence with the Columbia River. Sections 1 and 2 of the EPA approved Portland Harbor Programmatic RI/FS Work Plan (LWG, 2004a) present detailed descriptions of the site background for Portland Harbor. Section 3.0 of the RI/FS work plan and the LWG's Conceptual Site Model Update (LWG, 2004b) presents a preliminary description of: 1) the types of contaminants found in the harbor and potential upland sites, 2) general sources of contamination threatening the river, and 3) contaminant transport.

2.3 Regulatory Framework

The JSCS will use existing regulatory and management authorities to address source control needs for the Portland Harbor Superfund Site. Regulatory authority for source control is shared between DEQ and EPA. The role and responsibility of each agency is described in Section 2.4.

Potentially Responsible Parties (PRPs) (*e.g.*, private property owners, public agencies, municipalities, businesses, industries) located within the Portland Harbor Superfund Site may be required to implement and/or operate under appropriate regulations that address protection of the Willamette River. Source Control Decision documents for each upland site should identify the regulations that apply to the contaminated media and the recommended source control measure. Appendix A presents an overview of regulations that may apply to upland sites within the Portland Harbor Superfund Site; this list is presented for informational purposes only and should not be considered comprehensive or complete.

[1] It should be noted that the term "high priority" in Figure 2-1 is not referring to a site's source control priority. The term "high priority" was assigned based on DEQ's initial evaluation of the potential threats posed by contamination at the site and for the need for additional site characterization (See Appendix B for further discussion of DEQ's site evaluation process).

Source control measures should meet all applicable or relevant and appropriate local, state, and federal regulations. Upland investigations, source control evaluations, and source control measures will be performed in accordance with DEQ environmental cleanup regulations. High priority sites, which appear to be an ongoing and substantial source of contamination to the river, may be required to perform a remedial investigation and evaluate (*e.g.,* focused feasibility study (FFS), engineering evaluation and cost analysis (EE/CA)), design, and implement necessary source control measures. If the responsible party refuses to perform the required work, DEQ may, at its discretion, issue a unilateral order for the performance of the necessary investigation and source control measure. If the party refuses to comply with the unilateral order, DEQ has the option of enforcing the order, declaring the site a State orphan site and performing the work itself, or referring the site to EPA.

2.4 Roles and Responsibilities

The MOU established the relationship between the following governmental parties: EPA, DEQ, signatory Tribes,[2] and other state and federal Parties.[3] The MOU was based on CERCLA statute, the NCP, and the Portland Harbor Cleanup Statement of General Principles developed jointly by EPA and DEQ and attached to Governor John Kitzhaber's NPL listing concurrence letter. The MOU is also based on the signatory Tribes' and other state and federal Parties' express authority under CERCLA, and rights and responsibilities as set forth in the United States Constitution, treaties, statutes, executive orders, and court decisions. If, at the time of the EPA Portland Harbor ROD(s), upland sources are uncontrolled, they may be considered for CERCLA cleanup.

Under the MOU, the DEQ was designated the lead for the identification and control of upland contaminant sources to the Portland Harbor Superfund Site. DEQ is using its state environmental cleanup laws[4] and other state authorities to implement and require needed source control measures. The EPA was designated lead for investigating the nature and extent of in-water contamination, estimating the risks to human health and the environment from exposure to the in-water contamination, identifying and evaluating remedial action alternatives, and selecting a remedial action to address in-water contamination.

The MOU also specifically requires the DEQ and EPA to jointly develop a source control strategy. That strategy, which is documented herein, addresses the release of hazardous substances from:

- Upland sites being investigated under Oregon Revised Statute (ORS) 465;
- Waste management activities;
- Permitted and unpermitted storm water discharges;
- Other permitted and unpermitted discharges;
- Overland run-off and other non-point sources; and

[2]The Confederated Tribes of Siletz Indians, the Confederated Tribes of the Grand Ronde Community of Oregon, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Nez Perce Tribe.

[3] U.S. Fish and Wildlife, National Oceanic and Atmospheric Administration, Oregon Department of Fish and Wildlife, the U.S. Department of the Interior,

[4] Oregon Revised Statute (ORS) 465.200 et seq. and Oregon Administrative Rules (OAR) 340-122-0010 to 0140.

- Direct discharges resulting from spills and other over or in-water releases.

DEQ may require individual responsible parties to identify, evaluate, and control, the release of hazardous substances and pollutants to the Willamette River such that Federal and State standards and criteria and remedial action objectives established for the Portland Harbor Superfund Site are achieved to the extent practicable. This document contains the framework and schedule for identifying and evaluating those sources and outlines a process for developing effective controls. Such efforts include identifying potential sources resulting from current or historic operations, confirming whether these sources have a complete migration pathway to Portland Harbor, determining whether control measures are required to address ongoing sources of contaminant migration to the harbor, and designing and implementing source control measures. DEQ's site discovery and site evaluation process is described in Appendix B for informational purposes.

The EPA has entered into an Administrative Order on Consent (AOC) with a group of responsible parties who are members of the Lower Willamette Group[5] (LWG). Under the terms of the AOC, the LWG is responsible for the performance of a RI/FS that addresses the in-water portion of the site. EPA approved the work plan for the Portland Harbor RI/FS in April 2004 (LWG, 2004a and 2004b). The JSCS is a companion document to the RI/FS work plan.

2.5 Upland Source Control Coordination with In-Water RI/FS

Because upland source control efforts and the in-water characterization are proceeding in parallel, coordination is required between the upland work overseen by the DEQ and the in-water work overseen by the EPA. The in-water portion of the Portland Harbor RI/FS is designed to characterize the nature and extent of contamination in the river (*e.g.*, sediment, groundwater, transition zone water, and/or surface water) and to evaluate the risks to human health and the environment for in-water receptors. The results of the in-water risk evaluation will be used to establish contaminant specific cleanup levels for the Portland Harbor Superfund Site if applicable or relevant and appropriate requirements (ARARs) do not exist or more stringent risk-based levels are needed. Upland sources that prevent the in-water cleanup levels from being achieved should be controlled.

DEQ and EPA coordination hinges on effective information sharing during the Portland Harbor RI/FS and upland source control evaluation and implementation. This section provides a brief description of the basic tools that will be used by DEQ, EPA, and partners to ensure effective coordination.

2.5.1 Technical Coordination Team

The MOU established a Technical Coordination Team (TCT) comprised of members of the lead governmental parties (EPA, DEQ, and Tribes and other state and federal Parties signatory to the MOU). The TCT is the principal means of coordination and communication of data and information concerning the Portland Harbor Superfund Site. Through the MOU, it was agreed

[5] As of June 2005, the following companies have signed the AOC: ATOFINA (a.k.a. Arkema) Chemicals, Inc.; Chevron U.S.A. Inc.; Gunderson, Inc.; Northwest Natural Gas; City of Portland; Port of Portland; Time Oil Co.; Tosco Corporation; Union Pacific Railroad Company; and Oregon Steel Mills.

that EPA and DEQ would regularly review the activities of the other in TCT meetings. The meetings also allow the parties to discuss project progress, issues, and schedules. DEQ will also hold source control-specific meetings with representatives of EPA and other governmental parties on the TCT for purposes such as source control site prioritization and source control status updates as described in Section 7.0.

In DEQ's support role to EPA's oversight of the in-water investigation, upland information will be shared during the TCT meetings that may be relevant to: the in-water RI/FS; the design, evaluation, and implementation of in-water early actions; and the design, evaluation, and implementation of upland source control measures. Likewise, EPA will share in-water RI/FS information with DEQ that would assist in upland investigation and source control.

In the event implementation issues arise, the MOU provides for a dispute resolution process.

2.5.2 Portland Harbor Conceptual Site Model –Site Summary Reports

The *Portland Harbor Conceptual Site Model* (CSM) report developed by the LWG (LWG, 2004c) provides a preliminary description of Willamette River hydrology, regional geology, potential contamination sources, and migration pathways to the river. An updated CSM is expected to be included in the Comprehensive Round 2 Site Characterization Summary Report and the Remedial Investigation Report. These reports are expected to include updated "Site Summary Reports" for selected upland facilities identified in the CSM report. These summary reports summarize the history of the facility and available environmental data and are submitted to EPA for review and approval. For upland sites with a DEQ project manager, these summary reports are reviewed for accuracy and completeness. The LWG is required to update these summaries on a periodic basis as described in the CSM report. In addition, DEQ may require, at its discretion, upland facilities to update these summaries at key points in the project to facilitate information sharing or to support upland facility source control decisions. While CSMs are a useful tool to communicate upland site impacts on the river, the key documents for presenting pertinent source control information are the Source Control Evaluation, Source Control Decision and implementation documents, as discussed in the following sections.

2.5.3 Upland Site Investigations

DEQ, in its lead for upland investigation and source control decisions, will use its regulatory authorities to identify and evaluate potential sources of contamination to the river and require facilities to characterize and control contaminant releases. DEQ's source control decision process is presented in Section 4.0. Additionally, Appendices B, C, and D provide the general processes for: identifying potential sources of contamination; characterizing contaminant sources and assessing if a complete contaminant migration pathway from the source to the river exists; and investigating storm water. These appendices present DEQ's guidance for upland source control and are provided as general information only.

In-water characterization efforts performed by upland PRPs for the purpose of source control evaluation will be designed to the extent practicable to support the in-water RI/FS. Similarly, the elements and results of the in-water characterization and risk assessment for the purpose of the RI/FS may be used to evaluate contaminant discharges from upland sources to the Willamette River and to determine if source control is required. Elements of the RI/FS include consideration of the results of the cultural resource survey, bathymetric surveys, the evaluation of sediment transport processes within Portland Harbor, natural attenuation potential, and the evaluation of background concentrations of chemicals in Willamette River sediments.

Upland investigations and source control activities will proceed on a parallel track with the in-water RI/FS and will be coordinated with the RI/FS efforts to the extent practicable. Upland and in-water work will be integrated by achieving the following goals:

- Upland data gaps will be filled in a time-frame compatible with the overall Portland Harbor RI/FS;
- Upland sources will be controlled in a time-frame compatible with the evaluation, selection, design and implementation of remedial actions within the Portland Harbor Superfund Site;
- In-water data regarding the nature and extent of contamination in all media will be integrated into the evaluation, design and implementation of upland source control measures to the extent necessary to ensure effective source control; and
- Upland source control may be necessary for implementation of early cleanup actions in the river.

Source Control Evaluation, Source Control Decision and implementation documents that contain basic relevant site information to support source control determinations will be shared with EPA for review and comment as described in Section 7.0.

Additionally, DEQ may coordinate upland site visits for EPA and its partners to expedite review or to facilitate integration of upland and in-water investigations or source control activities.

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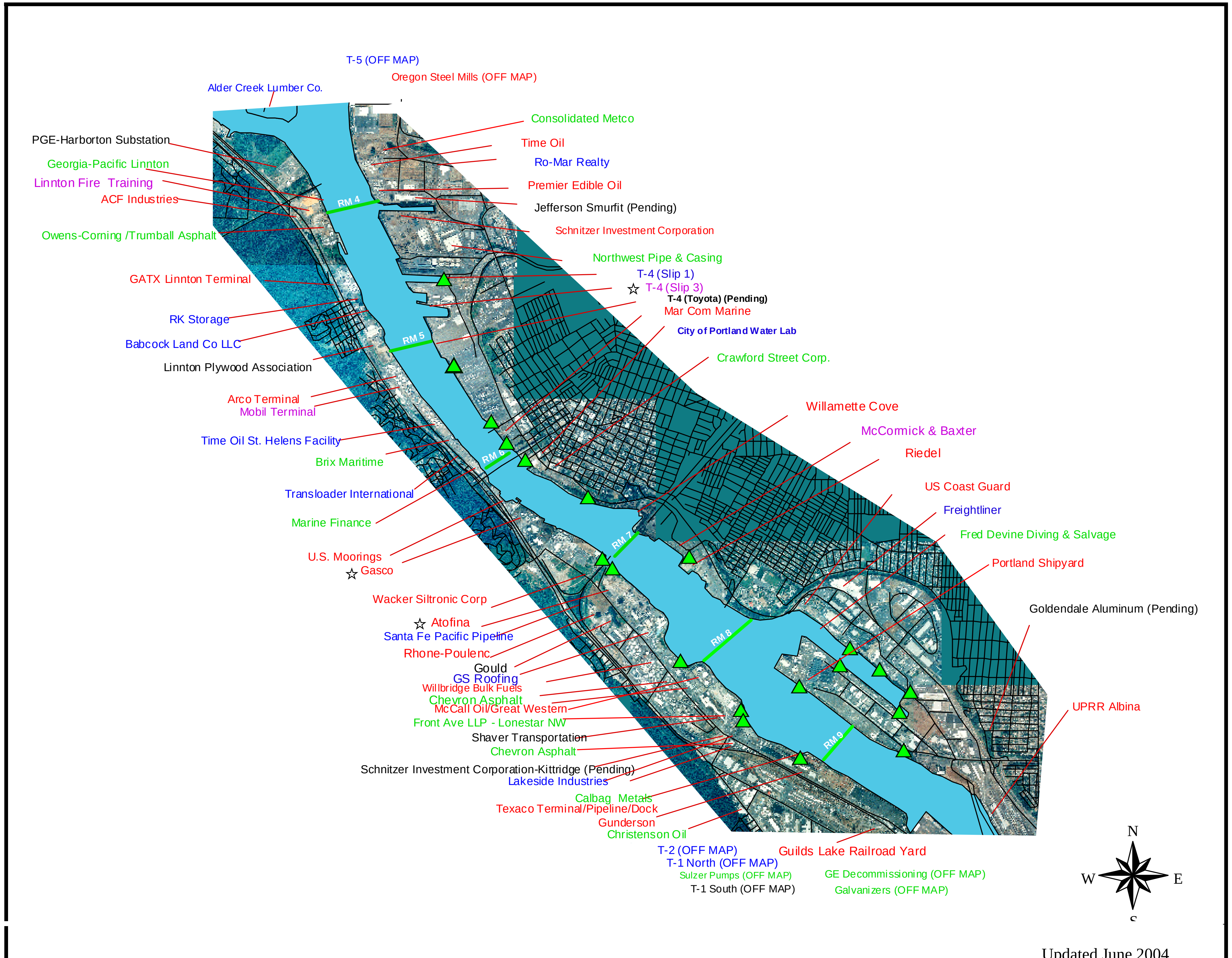

Portland Harbor Upland Cleanup Sites

Black sites –	Not a source of continuing contamination to the river (9)
Purple Sites –	Cleanup Underway (4)
Red Sites –	High Priority* Remedial Investigation (23)
Green Sites –	High Priority* Expanded Preliminary Assessment (14)
Blue Sites –	Medium/Low* Priority Preliminary Assessment (15)

T City of Portland BES Outfalls (~20)

Ú Early Action Sites

* The priority noted on this map refers to the DEQ assigned priority for further remedial action (See Appendix B for further information and not the assigned source control priority (See Section 4.4 for further information).

Note: For map updates and to view the map in more detail visit DEQ's website at:

http://www.deq.state.or.us/nwr/PortlandHarbor/phmap.pdf

Figure 2-1: Portland Harbor Upland Site Map

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Section 3 Screening Level Values

3.1 General

This section describes the screening level values (SLVs) used in the JSCS to assess threat to the Willamette River from upland sources. The JSCS SLVs are presented in Table 3-1. First, the sources of contamination and the nature and extent of contamination at a site are adequately characterized. When a potentially complete contaminant migration pathway to the river is identified, site-specific contaminant concentrations for each potential contaminant migration pathway (e.g., soil, storm water, groundwater) are compared to appropriate SLVs. If a pathway SLV is exceeded, DEQ will evaluate the site, using the factors described in Section 4.4, to determine the priority for implementing upland source control measures. Additionally, contaminants exceeding an SLV will be considered site-specific contaminants of potential concern (COPC) for the site and should be carried forward into subsequent source control decisions.

An exceedance of an SLV does not necessarily indicate the upland source of contamination poses an unacceptable risk to human or ecological receptors, but does require the further consideration of source control efforts using a weight-of-evidence evaluation. Decisions to implement source control, prior to the EPA Portland Harbor ROD(s), due to an exceedance of an SLV will be prioritized and evaluated on a case-by-case basis, as described in Sections 4.0 and 5.0.

3.2 Screening Level Value Definition

The SLVs presented in Table 3-1 were chosen to evaluate the potential threat from upland hazardous substance releases to the Willamette River. The SLVs were developed to conservatively identify potential threats to human health and the environment including potential toxicity to ecological receptors and bioaccumulation. Prior to using Table 3-1, DEQ's website should be checked for updates to this table[1]. SLVs presented in Table 3-1 may be revised or augmented in the event that the standards, criteria, or guidelines, or toxicological data are updated and/or Portland Harbor site-specific preliminary remediation goals or risk criteria are approved by EPA. It should be noted that the SLVs are not cleanup levels; they are comparisons used to establish priority for potential source control. The EPA Portland Harbor ROD(s) will establish contaminant specific cleanup levels for the Superfund Site using applicable or relevant and appropriate requirements (ARARs) or risk-based levels.

DEQ and EPA recognize that some of the SLVs are below naturally occurring background levels. Both DEQ cleanup regulations and CERCLA allow consideration of naturally occurring background in site characterization, risk assessment, and when developing cleanup levels. Regional background concentrations for upland soils, groundwater, and storm water sediment are not currently available. DEQ will consider background information submitted by upland PRPs for naturally occurring chemicals in the screening process presented in Section 4.0 and in the source control weigh-of-evidence process described in Sections 4.0 and 5.0.

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[1] Any references to Table 3-1 should include the revision date. Updates to Table 3-1 may be found on DEQ's Portland Harbor Website at http://www.deq.state.or.us/nwr/PortlandHarbor/jscs.htm.

The strategy for defining SLVs for the JSCS was broken into the following steps:

Step 1- Determine which Portland Harbor Chemicals of Interest (COI) are Potential Bioaccumulative Chemicals- Potential bioaccumulative chemicals in the Portland Harbor project include: (1) those COIs that were detected in Round 1 organisms, and/or (2) those COIs that may accumulate in and on an organism due to the net accumulation of those chemicals in the organism as a result of uptake from all environmental sources, including water, sediments, and diet. The purpose of identifying potential Portland Harbor bioaccumulative COIs is that specific sediment bioaccumulation SLVs exist for many of the COI, and those bioaccumulative SLVs are of special interest in the source control screening process.

The octanol-water partition coefficient (K_{ow}) is often used to estimate bioaccumulation potential. Toxic compounds that are both hydrophobic (*i.e.*, have a low aqueous solubility) and persistent (*i.e.*, do not break down easily) have a tendency to bioaccumulate. Compounds with a log (K_{ow}) that are equal to or greater than 3.5 are considered potential bioaccumulatives for the purpose of this document and are designated by as "+" in the "Potential Bioaccumulative Chemical" column of Table 3-1. It should be noted that literature values for log K_{ow} can vary for an individual chemical. Therefore, if sampling results show that a contaminant exists at a site with a log K_{ow} in the neighborhood of 3.5, a range of the log K_{ow} values may be considered as part of the weight-of-evidence evaluation for a medium-priority site as described in Sections 4.0 and 5.0.

Table 3-1 includes columns for (1) indicating the COI detected in Portland Harbor Round 1 fish tissue; and (2) the chemicals that have a potential to bioaccumulate based on log K_{ow}. In the "COI Detected in Portland Harbor Round 1 Fish Tissue" column, a " ***** " means that the contaminant was analyzed and detected in fish tissue. However, it is important to note that limited fish tissue was collected; tissue was not collected in all areas; tissue samples were not analyzed for all compounds listed in Table 3-1 (*e.g.*, volatile organic compounds (VOCs)); and the laboratory detection limits may not have been adequate for all analyses. For example, , the method reporting limits (MRLs) for polynuclear aromatic hydrocarbons (PAHs) in Round 1 fish tissue were elevated above the Portland Harbor RI/FS project analytical concentration goals (ACGs), and perhaps as a result, limited PAHs were detected in Round 1 fish tissue. Therefore, human health fish consumption ambient water quality criteria (AWQC) and other criteria relevant to the fish consumption pathway should be applied to PAHs and other chemicals for which the AWQC are available even though these chemicals have not been detected in fish tissue, because of high MRLs or other causes. It should be noted that additional tissue sampling may identify additional bioaccumulative COIs. If acceptable empirical data indicate a chemical is not accumulating in aquatic biota of Portland Harbor (as determined by DEQ and EPA), then a chemical may not be treated as bioaccumulutive chemical regardless of its K_{ow}.

Step 2- SLVs for Chemicals in Water Taken up by Fish for Human Consumption- Two different sets of criteria for assessing potential bioaccumulation and bioconcentration[2] using two separate fish consumption rates are presented in the four columns composing the SLVs for human consumption of fish in Table 3-1. The first criteria are EPA's 2002 National Recommended Water Quality Criteria (NRWQC) for ingestion of organisms only, and the second criteria are from DEQ's 2004 Table 33[3] Ambient Water Quality Criteria (AWQC) for ingestion of organisms only from Oregon Administrative Rules (OAR) 340-41. Both EPA's NRWQC and DEQ's AWQC were developed using a fish consumption rate of 17.5 g/day. EPA under CERCLA authority has identified NRWQC or AWQC as potential ARARs. The hierarchy to be used to determine which SLVs to use is to first use EPA's NRWQC and second to use DEQ's AWQC. These values will be used as SLVs to screen groundwater, transition zone water, and direct discharge (*e.g.,* storm water) concentrations.

The most protective fish consumption rate to be used in the Portland Harbor Superfund project will be 175 g/day. This value will be used for screening surface water concentrations within the Willamette River. The hierarchy to be used for surface water to determine which SLVs to use is to first use EPA's NRWQC adjusted to the 175g/day fish consumption rate and second to use DEQ's AWQC adjusted to the 175g/ day fish consumption rate.

It should be noted that while site-specific NRWQC and AWQC for the organism only are considered protective of human health, these values do not consider exposures to piscivorous birds and mammals through the fish consumption pathway or to the fish itself.

Federal and state water quality criteria are also available for the combined intake of water and organisms which can be lower than the criteria for ingestion of the organism only. These values are not included in Table 3-1; however, EPA under CERCLA authority may identify these combined water and organism criteria as applicable or relevant and appropriate requirements (ARARs) in the EPA Portland Harbor ROD(s). Therefore, these criteria may be considered in the weight-of-evidence evaluations described in Sections 4 and 5.

Water quality criteria are not available for some contaminants (*e.g.*, cadmium, lead, tributyltin) that can bioaccumulate or bioconcentrate in biota. DEQ and EPA will consider using conservative exposure assumptions and chemical data to develop site-specific SLVs for these COI, and revise Table 3-1 at a later time. Until NRWQC or AWQC are available for these chemicals, other criteria may need to be applied for the purposes of determining the need for source control measures. The results of the Portland Harbor baseline risk assessment may also be used to determine whether upland sources chemicals without water quality criteria for aquatic life represent a risk to human health or the environment. If additional chemicals are identified as COI in Portland Harbor, these will be added to Table 3-1.

[2] Bioconcentration is the net accumulation of a substance by an aquatic organism as the result of uptake directly from the ambient water, through gill membranes or other external body sources.

[3] Table 20 from OAR 340-40 was superceded by Tables 33A, 33B, and 33C. As noted above, 33A and 33C were adopted by the Oregon Environmental Commission and were effective in February 2005. Implementation of Table 33B (*i.e.*, metals) is pending EPA approval; Table 20 is used for the compounds listed in Table 33B, pending approval and implementation.

Step 3- Determine SLVs for Chemicals in Water for Human Ingestion- Human health drinking water screening levels (Maximum Contaminant Levels (MCLs) and EPA Region 9 tap water Preliminary Remediation Goals (PRGs)) are included in Table 3-1. The Lower Willamette River has a DEQ designated beneficial use for public or private domestic water supply, "*with adequate pretreatment and natural quality that meets drinking water standards*." (OAR 340-041-0340 Table 340A). EPA under CERCLA authority has identified the Safe Drinking Water Act's MCLs as potential ARARs for Portland Harbor to evaluate the potential threat contamination poses to future river uses and to determine the potential need for source control measures. Thus, MCLs and tap water PRGs are appropriate to conservatively screen potential future uses of the Willamette River and groundwater or surface water discharging into the Willamette River. The final determination of whether MCLs are ARARs, and associated remedial targets, will be made in the EPA Portland Harbor ROD(s). In order to fully address what may be a future remedial goal for the Portland Harbor Superfund Site, representative contaminant concentrations in groundwater and storm water entering the river should be compared to drinking water levels (*i.e*., MCLs and PRGs) for screening purposes.

Step 4- Determine Toxicity SLVs for Chemicals in Water for Ecological Exposure- Water fraction ecological toxicity values are listed in three columns under "Ecological Receptors" in Table 3-1. The first of the columns contains EPA's 2002 NRWQC chronic values. The second of the columns contains DEQ's recently adopted Table 33A chronic AWQC. The third column contains Oak Ridge National Laboratory (ORNL) Toxicological Benchmark Lowest Chronic Values (LCVs) that were identified as Analytical Concentration Goals (ACGs) in the LWG's 2004 Portland Harbor Surface Water Field Sampling Plan (FSP). As with the human health water quality criteria, EPA under CERCLA authority may identify NRWQC or AWQC as potential ARARs in the EPA Portland Harbor ROD(s).

The hierarchy to be used to determine which toxicity SLVs to use is to first use EPA's chronic NRWQC. If no NRWQC chronic value exists for certain COI, then DEQ's Table 33A chronic AWQC values should be selected *(Note: Some values, primarily volatile organic compounds (VOCs), are taken from Table 33C, which are DEQ guidance values and are not criteria. Some metal concentrations are taken from DEQ's preceding Table 20*[4]*, which are more stringent that DEQ values proposed for Table 33B and are currently under discussion with EPA.)*. Finally, if no EPA NRWQC or DEQ AWQC exists, then use the lower value of acute AWQC or the ORNL Toxicological Benchmark values.

Step 5- Determine Toxicity SLVs for Chemicals in Soil and Storm Water Sediment- Sediment toxicity values used to screen upland soil and storm water sediment (e.g., catch basin, conveyance line, suspended sediment) are listed under the "Toxicity" column in Table 3-1. Because some dilution and attenuation is expected to occur as upland soil/storm water sediment are transported and deposited in the river as sediment, probable effect concentrations (PECs) are used rather than threshold effect concentrations (TECs). PECs predict sediment toxicity, whereas TECs predict the absence of sediment toxicity. There are several sources of PECs. The hierarchy used in the JSCS is to first use MacDonald's PEC (MacDonald, *et. al*., 2000). If no

[4] Table 20 from OAR 340-40 was superceded by Tables 33A, 33B, and 33C. As noted above, 33A and 33C were adopted the Oregon Environmental Commission and were effective in February 2005. Implementation of Table 33B (*i.e.*, metals) is pending EPA approval; Table 20 will be used for the compounds listed in Table 33B, pending approval and implementation.

MacDonald PEC values exist for certain COI, then other probable effect levels found in various literature sources (see Table 3-1 footnotes) will be used as screening levels.

Step 6- Determine the SLVs for Potential Bioaccumulative Chemicals in Soil and Storm Water Sediments for Ecological Exposure- Sediment bioaccumulation SLVs that were largely taken from DEQ's December 2001 "*Level II Ecological Risk Assessment Guidance"* are listed under the "Bioaccumulation" column in Table 3-1. The bioaccumulative SLVs are considered to be protective of a reasonable general class of piscivorous birds (Great Blue Heron) and/or mammals (mink) based on an acceptable drinking water concentration toxicity threshold value; they are not necessarily protective of human receptors. This acceptable drinking water value is converted into a sediment value using equilibrium partitioning. DEQ is currently developing Sediment Bioaccumulation Guidance. As part of preparing the guidance, DEQ will develop acceptable fish tissue values protective of piscivorous birds and mammals. These acceptable fish tissue values can then be back-calculated to develop water and sediment SLVs. Table 3-1 will be modified once these values are developed and accepted.

3.3 Practical Quantitation Limits (PQLs)

DEQ and EPA recognize that some of the SLVs presented in Table 3-1 are less than laboratory practical quantitation limits[5] (PQLs) using standard methods for a number of chemicals. In these cases, upland parties should evaluate whether alternative sampling approaches (e.g., cumulative sampling techniques, high volume) or alternative laboratory methods can be used to achieve the desired PQLs.

DEQ and EPA recognize that achieving the prescribed quantitation limits may require some modifications to the identified analytical method, such as additional sample cleanup steps or the use of alternate gas chromatographic column or detector systems for the analyses of certain matrices. Modifications should be within the framework of the applicable method, and any such modifications should be documented in the data validation report. When two or more analytical methods are available, the method with the lowest quantitation limit should be used.

Achieving the desired PQL is highly matrix dependent. Sample cleanups may be employed to attempt to overcome matrix interferences so that the PQLs for analytes can be met. For example, catch basin sediment and conveyance line sediment samples are often oily and require sample cleanup to reach acceptable PQLs. Sample dilution must be not be used as a substitute for sample cleanup.

If upland PRPs demonstrate, to DEQ's satisfaction, that the analyte cannot be detected at or below the SLV using the best commercially available analytical techniques after consideration of alternative sampling or analytical techniques, then alternative PQLs may be used, in lieu of SLVs for screening if the PRP demonstrates:

- PQLs are based on the best available sampling and analytical techniques;

[5] The PQL as the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operation conditions

- PQLs are developed, based on best commercially available analytical method detection limits[6]; and
- All analytical data used for the option are of known precision and accuracy.

[6] Method detection limits are defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the true value is greater than zero.

Table 3-1

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water [A]

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]		ALL UPLAND COIs	
	Water [C]									Soil/Stormwater Sediment[D]		Potential Portland Harbor Bioaccumulative COI? [B]	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
Chemical	EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[i]	MacDonald PECs and other SQVs [1]	DEQ 2001 Bioaccumulative Sediment SLVs [E]	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) [25]
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
Metals/Inorganics	Metals in these columns are expressed as dissolved metal in the water column except where noted		Metals in these columns are expressed in terms of total recoverable metal in the water coulmn				Metals in this column are expressed as dissolved metal in the water column except where noted	Metals in this column are expressed in terms of total recoverable metal in the water coulmn					
Aluminum (pH 6.5 - 9.0)[13]					(50-200)[29]	36,000	87					*	
Antimony	640	64	640	64	6	15		1600 [16]	30	64,000 [3]	10,000	*	
Arsenic	0.14	0.014	0.14	0.014	10	0.045	150		3.1[a]	33,000 [2]		*	
Arsenic III								190 [14]			4,000		
Cadmium[15]					5	18	0.094	0.38 [14]		4,980 [2]	3	*	
Chromium, total					100					111,000 [2]	4,200,000	*	
Chromium, hexavalent						110	11	11 [14]					
Copper[15]					1,300 = TT	1,500	2.7	3.6 [14]		149,000 [2]	10,000	*	
Lead[15]					15 = TT		0.54	0.54 [14]		128,000 [2]	128,000	*	
Manganese	100	10	100	10	(50)[29]	880			120	1,100,000 [6,9]		*	
Mercury			0.146	0.0146	2	11	0.77	0.012	1.3[b]	1,060 [2]		*	[21] +
Methyl Mercury	300 µg/kg [20]	30 µg/kg [20]	300 µg/kg [20]	30 µg/kg [20]		3.6			0.0028			*	[21] +
Nickel[15]	4,600	460	4,600	460		730	16	49 [14]		48,600 [2]	316,000	*	
Selenium	4,200	420	4,200	420	50	180	5 [19]	35 [14]		5,000 [4]	100	*	
Silver [15]					(100)[29]	180		0.12 [14]	0.36	5,000 [5, 4]		*	
Zinc[15]	26,000	2,600	26,000	2,600	(5,000)[29]	11,000	36	33		459,000 [2]	3,000	*	
Perchlorate						3.6							
Cyanide[18]	140	14	140	14	200	730	5.2	5.2					
Butyltins [12]													
Monobutyltin													
Dibutyltin													
Tributyltin						11	0.072				190	*	+
Tetrabutyltin													+
PCBs Aroclors													
Aroclor 1016						0.96				530 [9]	420	*	+
Aroclor 1221									0.28			*	+
Aroclor 1232									0.58			*	+
Aroclor 1242									0.053		2	*	+
Aroclor 1248									0.081	1,500 [9]	4	*	+
Aroclor 1254						0.034			0.033	300 [9]	10	*	+
Aroclor 1260									94	200 [9]		*	+
Aroclor 1262												*	+
Aroclor 1268												*	+

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water [A]

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]		ALL UPLAND COIs	
	Water [C]									Soil/Stormwater Sediment [D]		Potential Portland Harbor Bioaccumulative COI? [B]	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
	EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[j]	MacDonald PECs and other SQVs [1]	DEQ 2001 Bioaccumulative Sediment SLVs [E]	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) [25]
Chemical	17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate									
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
Total PCBs	0.000064	0.0000064	0.000064	0.0000064	0.5	0.034	0.014	0.014	0.14	676 [2]		*	+
PCB Congeners													+
All 209 PCB congener target analytes													
Chlorinated Herbicides													
Dalapon					200	1,100							
Dicamba						1,100							
MCPA													
Dichlorprop													
2,4-D					70	360							
2,4,5-TP (Silvex)					50	290							
2,4,5-T						360							
2,4-DB						290							+
Dinoseb					7	36							+
MCPP						360							
Organochlorine Pesticides													
α - BHC	0.0049	0.00049	0.0049	0.00049		0.011			2.2 [c]				+
β - BHC	0.017	0.0017	0.017	0.0017		0.037							+
γ - BHC (Lindane)	1.8	0.18	1.8	0.18		0.052		0.08		4.99 [2]			+
δ - BHC						0.037							+
Heptachlor	0.000079	0.0000079	0.000079	0.0000079	0.4	0.015	0.0038	0.0038	0.0069	10 [6]		*	+
Heptachlor epoxide	0.000039	0.0000039	0.000039	0.0000039	0.2	0.0074	0.0038	0.0038		16 [2]		*	+
Aldrin	0.00005	0.000005	0.00005	0.000005		0.004				40 [6]			+
Chlordane	0.00081	0.000081	0.00081	0.000081	2	0.19	0.0043	0.0043		17.6 [2]		*	+
Endosulfan alpha-	89	8.9	89	8.9		220	0.056	0.056	0.051				+
Endosulfan beta-	89	8.9	89	8.9		220	0.056	0.056	0.051				+
Endosulfan sulfate	89	8.9	89	8.9								*	+
4,4'-DDE	0.00022	0.000022	0.00022	0.000022		0.2				31.3 [2]	0.3	*	+
4,4'-DDD	0.00031	0.000031	0.00031	0.000031		0.28			0.011 [d]	28 [2]	0.3	*	+
4,4'-DDT	0.00022	0.000022	0.00022	0.000022		0.2	0.001	0.001	0.013 [e]	62.9 [2]	0.3	*	+
DDT - total						0.2					0.3	*	+
Dieldrin	0.000054	0.0000054	0.000054	0.0000054		0.0042	0.056	0.0019 [14]		61.8 [2]		*	+
Endrin	0.06	0.006	0.06	0.006	2	11	0.036	0.0023 [14]	0.061	207 [2]			+
Endrin aldehyde	0.3	0.03	0.3	0.03								*	+
Endrin ketone													+
Methoxychlor					40	180	0.03	0.03	0.019			*	+
Toxaphene	0.00028	0.000028	0.00028	0.000028	3	0.061	0.0002	0.0002					+
oxy chlordane						0.19							+
cis - nonachlor						0.19							+
trans - nonachlor						0.19						*	+
Volatile Organic Compounds													
1,1,1,2- Tetrachloroethane						0.43							
1,1,1- Trichloroethane (TCA)					200	3,200			11				
1,1,2,2- Tetrachloroethane	4	0.4	4	0.4		0.055		2,400 [16]	610				
1,1,2- Trichloroethane	16	1.6	16	1.6	5	0.2		9,400 [16]	1,200				

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water [A]

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]		ALL UPLAND COIs	
	Water [C]									Soil/Stormwater Sediment [D]		Potential Portland Harbor Bioaccumulative COI? [B]	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
	EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[j]	MacDonald PECs and other SQVs [1]	DEQ 2001 Bioaccumulative Sediment SLVs [E]	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) [25]
Chemical	17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate									
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
1,1- Dichloroethane						810			47				
1,2,3- Trichloropropane						0.0056							
1,2- Dichloroethane (EDC)	37	3.7	37	3.7	5	0.12		20,000 [16]	910				
cis-1,2-Dichloroethlyene					70	61							
1,2- Dichloropropane	15	1.5	15	1.5	5	0.16							
1,2- Dibromoethane (EDB)						0.0056							
2- Butanone (MEK)						7,000			14,000				
2- Chloroethyl Vinyl Ether													
2- Hexanone									99				
4- Methyl-2-Pentanone (MIBK)									170				
Acetone						5,500			1,500				
Acrolein	290	29	290	29		0.042		21 [16]					
Acrylonitrile	0.25	0.025	0.25	0.025		0.039		2,600 [16]					
Bromochloromethane													
Bromodichloromethane						0.18							
Bromoform	140	14	140	14		8.5							
Bromomethane						8.7							
Carbon Disulfide						1,000			0.92				
Carbon Tetrachloride	1.6	0.16	1.6	0.16	5	0.17			9.8				
Chlorobenzene	1600	160	1,600	160	100	110		50 [16]	64				
Chlorodibromomethane	13	1.3	13	1.3									
Chloroethane						4.6							
Chloroform	470	47	470	47		0.17		1,240 [16]	28				
Chloromethane						160							
cis-1,3-Dichloropropene									0.055				
Dibromomethane													
Dichlorodifuoromethane						390							
Iodomethane (Methyl Iodide)													
Isopropylbenzene													+
Methylenechloride	590	59	590	59		4.3			2,200				
Styrene					100	1,600							
trans-1,4-Dichloro-2-butene													
Trichlorofluoromethane						1,300							
Vinyl Acetate						410			16				
Benzene	51	5.1	51	5.1	5	0.35			130				
EthylBenzene	2,100	210	2,100	210	700	1,300			7.3				
m,p-Xylene									1.8[f]				
o-Xylene									13[g]				
Xylenes (total)					10,000								
Methyltert-butyl ether						11							
Tetrachloroethene (PCE)	3.3	0.33	3.3	0.33	5	0.1		840 [16]	98	500[7]			
Toluene	15,000	1,500	15,000	1,500	1,000	720			9.8				
trans-1,2-Dichloroethene	10,000	1,000	10,000	1,000	100	0.12			590				
trans-1,3-Dichloropropene						0.4			0.055				
Trichloroethene (TCE)	30	3	30	3	5	0.028		21,900 [16]	47	2,100[7]			
Vinyl Chloride	2.4	0.24	2.4	0.24	2	0.02							
Semivolatile Organic Compounds													

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (A)

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT (D)		ALL UPLAND COIs	
	Water (C)									Soil/Stormwater Sediment (D)		Potential Portland Harbor Bioaccumulative COI? (B)	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
Chemical	EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV) (j)	MacDonald PECs and other SQVs (1)	DEQ 2001 Bioaccumulative Sediment SLVs (E)	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) (25)
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
Halogenated Compounds													
1,2-Dichlorobenzene	1,300	130	1,300	130	600	370		763 (16)	14	1,700 (7)			
1,3-Dichlorobenzene	960	96	960	96		180		763 (16)	71	300 (7)			
1,4-Dichlorobenzene	190	19	190	19	75	0.5		763 (16)	15	300 (7)			
1,2,4-Trichlorobenzene	70	7	70	7	70	7.2			110	9,200 (7)			+
Hexachlorobenzene	0.00029	0.000029	0.00029	0.000029	1	0.042				100 (6)		*	+
2-Chloronaphthalene	1,600	160	1,600	160		490							
Hexachloroethane	3.3	0.33	3.3	0.33		4.8		540 (16)	12			*	+
Hexachlorobutadiene	18	1.8	18	1.8		0.86		9.3 (16)		600 (8)		*	+
Hexachlorocyclopentadiene	1,100	110	1,100	110	50	220		5.2 (16)		400 (8)			+
2,2'-oxybis(1-chloropropane)													
Bis-(2-chloroethoxy) methane													
Bis-(2-chloroethyl) ether	0.53	0.053	0.53	0.053		0.01							
4-Chlorophenyl-phenyl ether													+
4-bromophenyl-phenyl ether													+
3,3'-Dichlorbenzidine	0.028	0.0028	0.028	0.0028		0.15		763 (16)					+
4-Chloroaniline						150							
Organonitrogen Compounds													
Nitrobenzene	690	69	690	69		3.4							
Aniline						12							
2-Nitroaniline						110.0							
3-Nitroaniline						3.2							
4-Nitroaniline						3.2							
N-Nitrosodimethylamine	3	0.3	3	0.3		0.0013							
N-Nitroso-di-n-propylamine	0.51	0.051	0.51	0.051		0.0096							
N-Nitrosodiphenylamine	6	0.6	6	0.6		14			210				
2,4-Dinitrotoluene	3.4	0.34	3.4	0.34		73							
2,6-Dinitrotoluene						36							
Carbazole						3.4				1,600 (5)			+
Oxygen-Containing Compounds													
Benzoic Acid						150,000			42				
Benzyl Alcohol						11,000			8.6				
Dibenzofuran						12			3.7			*	+
Isophorone	960	96	960	96		71							
Phenols and Substituted Phenols													
Phenol	1,700,000	170,000	1,700,000	170,000		11,000		2,560 (16)		50 (5, 6)		*	
2-Methylphenol (o-Cresol)						1,800			13				
4-Methylphenol (p-Cresol)						180						*	
2,4-Dimethylphenol	850	85	850	85		730							
2-Chlorophenol	150	15	150	15		30		2,000 (16)					
2,4-Dichlorophenol	290	29	290	29		110		365 (16)					
2,4,5-Trichlorophenol	3,600 (24)	360 (24)	3,600	360		3,600							+
2,4,6-trichlorophenol	2.4	0.24	2.4	0.24		3.6		970 (16)					+
2,3,4,6-Tetrachlorophenol						1,100							+
Pentachlorophenol	3	0.3	3	0.3	1	0.56	15 (22)	13 (14,23)		1,000 (8)			+

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (A)

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT (D)		ALL UPLAND COIs	
	Water (C)									Soil/Stormwater Sediment (D)		Potential Portland Harbor Bioaccumulative COI? (B)	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
Chemical	EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV) (j)	MacDonald PECs and other SQVs (1)	DEQ 2001 Bioaccumulative Sediment SLVs (E)	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) (25)
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
4-Chloro-3-methylphenol													
2-Nitrophenol								150 (16)					
4-Nitrophenol								150 (16)	300				
2,4-Dinitrophenol	5,300	530	5,300	530		73		150 (16)					
Methyl-4,6-Dinitrophenol 2-	280	28	280	28				150 (16)					
Phthalate Esters													
Dimethylphthalate	1,100,000	110,000	1,100,000	110,000		360,000		3 (16)					
Diethylphthlalate	44,000	4,400	44,000	4,400		29,000		3 (16)	210	600 (7)			
Di-n-butylphthalate	4,500	450	4,500	450		3,600		3 (16)		100 (6)			+
Butylbenzylphthalate	1900	190	1900	190		7,300		3 (16)	19				+
Di-n-octylphthalate						1,500		3 (16)				*	+
bis(2-Ethylhexyl)phthalate	2.2	0.22	2.2	0.22	6	4.8		3 (16)		800 (5, 6)	330	*	+
Polycyclic Aromatic Hydrocarbons													
Naphthalene					0.2 (26)	6.2		620 (16)	12	561 (2)		*	
2-Methylnaphthalene					0.2 (26)				2.1 (h)	200 (11)		*	+
Acenaphthylene					0.2 (26)					200 (6)			+
Acenaphthene	990	99	990	99	0.2 (26)	370		520 (16)		300 (6)		*	+
Fluorene	5,300	530	5,300	530	0.2 (26)	240			3.9	536 (2)		*	+
Phenanthrene					0.2 (26)					1,170 (2)		*	+
Anthracene	40,000	4,000	40,000	4,000	0.2 (26)	1,800			0.73	845 (2)			+
Fluoranthene	140	14	140	14	0.2 (26)	1,500				2,230 (2)		*	+
Pyrene	4,000	400	4,000	400	0.2 (26)	180				1,520 (2)		*	+
Benzo(a)anthracene	0.018	0.0018	0.018	0.0018	0.2 (26)	0.092			0.027	1,050 (2)			+
Chrysene	0.018	0.0018	0.018	0.0018	0.2 (26)	9.2				1,290 (2)			+
Benzo(b)fluoranthene	0.018	0.0018	0.018	0.0018	0.2 (26)	0.092							+
Benzo(k)fluoranthene	0.018	0.0018	0.018	0.0018	0.2 (26)	0.92				13,000 (6)			+
Benzo(a)pyrene	0.018	0.0018	0.018	0.0018	0.2	0.0092			0.014	1,450 (2)			+
Indeno(1,2,3-cd)pyrene	0.018	0.0018	0.018	0.0018	0.2 (26)	0.092				100 (10)			+
Dibenz(a,h)anthracene	0.018	0.0018	0.018	0.0018	0.2 (26)	0.0092				1,300 (9)			+
Benzo(g,h,i)perylene					0.2 (26)					300 (16)			+
Chlorinated Dioxins and Furans													
2,3,7,8,-TCDD (Toxicity Equivalence Quotient)	5.1E-09	5.1E-10	5.1E-09	5.1E-10	0.00003	4.5E-07						*	+
2,3,7,8,-TCDD	5.1E-09	5.1E-10	5.1E-09	5.1E-10		4.5E-07		0.00038 (16)		9.0 E-3 (6)	8.5 E-7	*	+
2,3,7,8-TCDF												*	+
1,2,3,7,8-PeCDD												*	+
1,2,3,7,8-PeCDF												*	+
2,3,4,7,8-PeCDF												*	+
1,2,3,4,7,8-HxCDD												*	+
1,2,3,6,7,8-HxCDD												*	+
1,2,3,7,8,9-HxCDD												*	+

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water [A]

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]		ALL UPLAND COIs	
	Water [C]									Soil/Stormwater Sediment[D]		Potential Portland Harbor Bioaccumulative COI? [B]	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
	EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[j]	MacDonald PECs and other SQVs [1]	DEQ 2001 Bioaccumulative Sediment SLVs [E]	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow ≥ 3.5) [25]
Chemical	17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate									
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
1,2,3,4,7,8-HxCDF												*	+
1,2,3,6,7,8-HxCDF												*	+
1,2,3,7,8,9-HxCDF													+
2,3,4,6,7,8-HxCDF												*	+
1,2,3,4,6,7,8-HpCDD												*	+
1,2,3,4,6,7,8-HpCDF												*	+
1,2,3,4,7,8,9-HpCDF												*	+
OCDD												*	+
OCDF												*	+
Total tetrachlorinated dioxins													+
Total pentachlorinated dioxins													+
Total hexachlorinated dioxins													+
Total heptachlorinated dioxins													+
Total tetrachlorinated furans													+
Total pentachlorinated furans													+
Total hexachlorinated furans													+
Total heptachlorinated furans													+
Polybrominated Biphenyls													

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Notes:

[A] Stormwater values in this table are intended for screening non-permitted discharges.

[B] MRLs for PAHs in Round 1 fish tissue were elevated above project ACHs, and perhaps as a result, limited PAHs and other compounds were detected. Therefore, human health fish consumption AWQCs and other criteria relevant to the fish consumption pathway should be applied to potential bioaccumulatives because non-detects may be the result of high MRLs or other causes.

[C] EPA, under CERCLA authority, has identified the Sage Drinking Water Act's MCLs and AWQCs (federal and state, once approved) as potentialARARs under CERCLA. The final determination of whether MCLs or AWQC are ARARs will be made in the EPA Portland Harbor Record of Decision (ROD). Decisions to implement source control, prior to the EPA Portland Harbor ROD, due to an exceedance of an SLV in upland groundwater or stormwater will be prioritized and evaluated on a case-by-case basis.

[D] Stormwater sediment is defined as either catch basin sediment, conveyance line sediment, or stormwater particulates

[E] All values are Level II Screening Level Values taken from DEQ Guidance for Ecological Risk Assessment, December 2001

* indicates that the contaminant was analyzed and detected in the Round 1 Portland Harbor fish tissue (filet or whole body analyses from sculpin, smallmouth bass, peamouth, northern pikeminnow, largescale sucker, chinook salmon, carp, brown bullhead, and black crappie; clam and crayfish data were not considered at this time). However, it is important to note that limited fish tissue was collected in Round 1; tissue was not collected in all areas; tissue samples were not analyzed for all compounds listed in this table (*e.g.,* volatile organic compounds (VOCs)); and the laboratory detection limits may not have been adequate for all analyses.

+ indicates a octanol-water partition coefficient (Kow) equal to or greater than 3.5 and are considered potential bioaccumulatives for the purposes of this document.

[ ] a blank cell indicates an SLV was not available at the time of the last update. DEQ or EPA may develop additional SLVs as determined necessary, on a case-by-case basis.

[1] The values were chosen by first referring to the PEC's in the paper listed in footnote 2. If the analyte was not found, we then used the other literature listed in footnotes 3 through 11 to find the value.

[2] These values were taken MacDonald DD, Ingersoll C.G., Berger T.A. (2000) Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Environmental Contamination and Toxicity 39: 20-31.

[3] Sediment quality value (Hyalella), Washington State, quoted in MacDonald et al. (1999); Appendix 3-1.

[4] Quoted in MacDonald et al. (1999); Appendix 3-1

[5] Lowest Apparent Effects Threshold (LAET), Table 11, WDOE (1997)

[6] Upper Effects Threshold (UET), Freshwater Sediment (NOAA, 1999)

[7] USEPA sediment quality advisory level, quoted in MacDonald et al. (1999); Appendix 3-1

[8] New York State acute criterion, quoted in MacDonald et al. (1999); Appendix 3-1

[9] Severe effect level, British Columbia, quoted in MacDonald et al. (1999); Appendix 3-1

[10] 5x conversion from measured "LOW" to estimated "HIGH", NOAEL to chronic LOAEL per USEPA (1997b)

[11] PEL, British Columbia, quoted in MacDonald et al. (1999); Appendix 3-1

[12] Based on Notice of Availability of Final Aquatic Life Criteria Document for Tributyltin (69 Fed. Reg. 2, 342). USGS web site (http://nwis.waterdata.usgs.gov/or/nwis/qwdata/?site_no=14211720&agency_cd=USGS).

[13] These values for aluminum are expressed in terms of "total recoverable" concentration of metal in the water column. The criterion applies at pH<6.6 and hardness<12 mg/L (as $CaCO_3$)

[14] These values were taken from OAR 340-41 Table 20 because they will remain the enforceable values for these particular analytes.

[15] This is a hardness dependent metal. All values were calculated based on 25 mg/l of $CaCO_3$.

[16] Values were taken from Table 33c (OAR 340-41), which are Water Quality Guidance Values, not criteria, that can be used in the application of Oregon's Narrative Toxics Criteria to waters of the state in order to protect aquatic life.

[17] The values for the Aroclors are based off the total PCB values

[18] Cyanide value is based on a free cyanide value per DEQ OAR 340-41 Table 33, and EPA values are based on total Cyanide

[19] This metal is listed as the total recoverable metal in the water column

[20] This fish tissue residue criterion for methylmercury is based on a total fish consumption rate of 0.0175 kg/day

[21] Although methyl mercury and mercury have logKow values less than 3.5, they are considered bioaccumlative chemicals because they bind to sulfur containing amino acids

[22] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.134). The value displayed in the table corresponds to a pH of 7.8

[23] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.29). The value displayed in the table corresponds to a pH of 7.8

[24] Listed as a secondary pollutant by EPA

[#] Table 20 from OAR 340-40 was superceded by Tables 33A, 33B, and 33C. As noted above, 33A and 33C were adopted the Oregon Environmental Commission and were effective in February 2005. Implementation of Table 33B (i.e., metals) is pending EPA approval; Table 20 will be used for the compounds listed in Table 33B, pending approval and implementation.

Kow

[25] Log Kow were taken from the following sources:

Table 39 of EPA's Soil Screening Levels Technical Document which can be found at http://www.epa.gov/OUST/cat/ssltbd.pdf

Mackay, Shiu, MA, 1997. Illustrated Hankbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals

Arnold, A.P., A.J. Canty, P.W. Moors and G.B. Deacon. 1983. Chelation therapy for methylmercury(II) poisoning. Synthesis and determination of solubility properties of MeHg(II) complexes of thiol and dithiol antidotes. J. Inorg. Biochem. 19:319-27.

Syracuse Research Corp.'s website that estimates log Kow values from chemical structures - at http://www.syrres.com/esc/est_kowdemo.htm

Tier II SCV

(a) = value for Arsenic V

(b) = see notation for ORNL's Mercury value

(c) = SCV for BHC (other)

(d) = SCV for p,p' DDD

(e) = SCV for p,p' DDT

(f) = SCV for m-Xylene

(g) = SCV for Xylene mixture

(h) = SCV for 1-Methylnaphthalene

(j) = Tier II SCV values were taken from Suter II, G.W. and Tsao, C.L., 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ORNL publication ES/ER/TM-96/R2

General

AWQC = ambient water quality criteria

MRL = minimum reporting limit

NRWQC = National Recommended Water Quality Criteria

ORNL = Oak Ridge National Laboratory

PRG = preliminary remediation goals

(!) Screening level values (SLVs) presented in this table may be revised or augmented as data become available from the Portland Harbor RI/FS or in the event the standards, criteria, guidelines or toxicological data are updated. Prior to using this Table, DEQ's website should be checked for updates to this table at http://www.deq.state.or.us/nwr/PortlandHarbor/jscs .

MCL

[26] MCL is based on benzo(a)pyrene

[29] National Secondary Drinking Water Standards

TT = see footnote 7 on EPA NPD Drinking Water Standards

[30] MCL for Xylene mixture

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water [(A)]

	GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [(D)]		ALL UPLAND COIs	
	Water [(C)]									Soil/Stormwater Sediment[(D)]		Potential Portland Harbor Bioaccumulative COI? [(B)]	
	Human Health #						Ecological Receptors #			Toxicity	Bioaccumulation		
	Fish Consumption				Drinking Water								
	EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[(j)]	MacDonald PECs and other SQVs [(1)]	DEQ 2001 Bioaccumulative Sediment SLVs [(E)]	COI Detected in Portland Harbor Round 1a Fish Tissue	Potential Bioaccumulative Chemical? (i.e. Log Kow≥ 3.5) [(25)]
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Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg		
1,2,3,4,6,7,8-HpCDD												*	+
1,2,3,4,6,7,8-HpCDF												*	+
1,2,3,4,7,8,9-HpCDF												*	+
OCDD												*	+
OCDF												*	+
Total tetrachlorinated dioxins													+
Total pentachlorinated dioxins													+
Total hexachlorinated dioxins													+
Total heptachlorinated dioxins													+
Total tetrachlorinated furans													+
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Total hexachlorinated furans													+
Total heptachlorinated furans													+
Polybrominated Biphenyls													

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Notes:

[A] Stormwater values in this table are intended for screening non-permitted discharges.

[B] MRLs for PAHs in Round 1 fish tissue were elevated above project ACHs, and perhaps as a result, limited PAHs and other compounds were detected. Therefore, human health fish consumption AWQCs and other criteria relevant to the fish consumption pathway should be applied to potential bioaccumulatives because non-detects may be the result of high MRLs or other causes.

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[D] Stormwater sediment is defined as either catch basin sediment, conveyance line sediment, or stormwater particulates

[E] All values are Level II Screening Level Values taken from DEQ Guidance for Ecological Risk Assessment, December 2001

* indicates that the contaminant was analyzed and detected in the Round 1 Portland Harbor fish tissue (filet or whole body analyses from sculpin, smallmouth bass, peamouth, northern pikeminnow, largescale sucker, chinook salmon, carp, brown bullhead, and black crappie; clam and crayfish data were not considered at this time). However, it is important to note that limited fish tissue was collected in Round 1; tissue was not collected in all areas; tissue samples were not analyzed for all compounds listed in this table (*e.g.*, volatile organic compounds (VOCs)); and the laboratory detection limits may not have been adequate for all analyses.

+ indicates a octanol-water partition coefficient (Kow) equal to or greater than 3.5 and are considered potential bioaccumulatives for the purposes of this document.

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[13] These values for aluminum are expressed in terms of "total recoverable" concentration of metal in the water column. The criterion applies at pH<6.6 and hardness<12 mg/L (as $CaCO_3$)

[14] These values were taken from OAR 340-41 Table 20 because they will remain the enforceable values for these particular analytes.

[15] This is a hardness dependent metal. All values were calculated based on 25 mg/l of $CaCO_3$.

[16] Values were taken from Table 33c (OAR 340-41), which are Water Quality Guidance Values, not criteria, that can be used in the application of Oregon's Narrative Toxics Criteria to waters of the state in order to protect aquatic life.

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[21] Although methyl mercury and mercury have logKow values less than 3.5, they are considered bioaccumlative chemicals because they bind to sulfur containing amino acids

[22] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.134). The value displayed in the table corresponds to a pH of 7.8

[23] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.29). The value displayed in the table corresponds to a pH of 7.8

[24] Listed as a secondary pollutant by EPA

[#] Table 20 from OAR 340-40 was superceded by Tables 33A, 33B, and 33C. As noted above, 33A and 33C were adopted the Oregon Environmental Commission and were effective in February 2005. Implementation of Table 33B (i.e., metals) is pending EPA approval; Table 20 will be used for the compounds listed in Table 33B, pending approval and implementation.

Kow

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Mackay, Shiu, MA, 1997. Illustrated Hankbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals

Arnold, A.P., A.J. Canty, P.W. Moors and G.B. Deacon. 1983. Chelation therapy for methylmercury(II) poisoning. Synthesis and determination of solubility properties of MeHg(II) complexes of thiol and dithiol antidotes. J. Inorg. Biochem. 19:319-27.

Syracuse Research Corp.'s website that estimates log Kow values from chemical structures - at http://www.syrres.com/esc/est_kowdemo.htm

Tier II SCV

(a) = value for Arsenic V

(b) = see notation for ORNL's Mercury value

(c) = SCV for BHC (other)

(d) = SCV for p,p' DDD

(e) = SCV for p,p' DDT

(f) = SCV for m-Xylene

(g) = SCV for Xylene mixture

(h) = SCV for 1-Methylnaphthalene

(j) = Tier II SCV values were taken from Suter II, G.W. and Tsao, C.L., 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ORNL publication ES/ER/TM-96/R2

General

AWQC = ambient water quality criteria

MRL = minimum reporting limit

NRWQC = National Recommended Water Quality Criteria

ORNL = Oak Ridge National Laboratory

PRG = preliminary remediation goals

(!) Screening level values (SLVs) presented in this table may be revised or augmented as data become available from the Portland Harbor RI/FS or in the event the standards, criteria, guidelines or toxicological data are updated. Prior to using this Table, DEQ’s website should be checked for updates to this table at http://www.deq.state.or.us/nwr/PortlandHarbor/jscs .

MCL

[26] MCL is based on benzo(a)pyrene

[29] National Secondary Drinking Water Standards

TT = see footnote 7 on EPA NPD Drinking Water Standards

[30] MCL for Xylene mixture

Section 4 Source Control Decision Process

The source control decision process described in this section is intended to help DEQ project managers determine if source control measures are required at upland Portland Harbor sites and if so the priorities for source control implementation. This decision is ultimately based on whether the contaminant release or potential for contaminant release has a current or reasonably likely future adverse effect on water or sediment quality in the Willamette River. The process was developed with the goal to complete source control prior to sediment cleanup activities within the Portland Harbor Superfund Site. The success of the Portland Harbor Cleanup Project relies on the timely and successful implementation of upland source control measures. The schedule for the Portland Harbor project currently calls for an EPA Portland Harbor ROD(s) in 2008; thus, adherence to the established schedule is critical to meet the objective. The following sections present the source control decision process. Figure 4-1 provides a simplified overview of the source control decision process.

4.1 Contaminant Migration Pathways

In order to discuss the steps to identify and manage sources, it is important to understand potential, current and historic contaminant sources and pathways to the Willamette River within the Portland Harbor Superfund Site. Media relevant to source control that can be contaminated by human activity are water, soil, and air. The Portland Harbor conceptual site model presented in the Programmatic Work Plan (LWG, 2004a, 2004b) identifies potential upland contaminant migration pathways that may impact the river, such as:

- *Direct discharges*: Pollutants from commercial, industrial, private, or municipal outfalls may be directly discharged to the Portland Harbor Superfund Site. Many of these discharges are permitted under the National Pollutant Discharge Elimination System (NPDES). Permitted discharges include industrial wastes, storm water runoff, and combined sewer overflows (CSOs)[1].
- *Groundwater*: Contaminated groundwater may enter directly into the Portland Harbor Superfund Site via discharge through sediments, bank seeps, or it may infiltrate into storm drains/pipes, ditches or creeks that discharge to the river. Contaminant migration may occur as non-aqueous phase liquids (NAPLs) or as dissolved phase transport.
- *Erosion/Leaching*: River bank soil, contaminated fill, waste piles, landfills, and surface impoundments may release contaminants directly to the Portland Harbor Superfund Site through erosion, via soil erosion to storm water, or by leaching to groundwater.
- *Overwater Activities*: Contaminants from overwater activities (*e.g.,* sandblasting, painting, unloading, maintenance, repair, and operations) at riverside docks, wharves, or piers; discharges from vessels (*e.g.*, gray, bulge, ballast); fuel releases; and spills may impact the Portland Harbor Superfund Site.

[1] CSO events are untreated discharges of combined storm water, and sanitary sewage from residential, commercial, and industrial sources that overflow from the sewer system into the river during heavy rainfall periods when the amount of storm water and sewage exceeds the capacity of the collection system.

- *Air pollution*: Air pollution (e.g., vehicle emissions, industrial smokestacks, fugitive dust, etc.) can enter the river directly or through storm water and become a possible source of contamination to the Portland Harbor Superfund Site.

The pathways of vessel traffic and air pollution are not specifically discussed because they are expected to be addressed under one of the other pathways (*e.g*., upland air deposition or urban spills that are carried to the river through storm water runoff will be considered under storm water screening). These pathways can be controlled with physical actions (source removal, best management practices (BMPs), etc.) and/or administrative actions (orders, permits, etc.).

4.2 Upland Site Characterization

In general, upland site characterization activities follow the CERCLA Preliminary Assessment (PA), Site Investigation (SI), Remedial Investigation (RI) process outlined in DEQ and EPA guidance. Upland investigations should focus on identifying whether there is a complete contaminant migration pathway to the Willamette River and screening contaminants that may be present on-site (*i.e*., COIs) to identify those contaminants that may adversely impact the river (*i.e*., COPCs). A complete contaminant migration pathway to the river includes media impacted by contaminants at an upland facility (sources) and a process by which that contaminant is transported to the Willamette River. In some cases, PA or SI level information may be adequate to determine whether or not an upland facility is a source of contamination (*i.e.,* whether or not a complete contaminant migration pathway exists) to the Willamette River. However, it may be necessary to collect RI level data at upland sites to determine whether or not an upland facility is a source of contamination to the Willamette River. Most upland site investigations will be conducted under the oversight of DEQ, and in accordance with Oregon environmental regulations. DEQ's site discovery and evaluation process are presented in Appendix B and DEQ's expectations for site characterization for upland sites are presented in Appendix C. Figure 4-2 provides an overview of the DEQ site discovery and evaluation process. DEQ's discovery, evaluation, and characterization processes are provided for information purposes only.

4.3 Upland Source Control Screening

The source control screening process is an iterative process requiring the upland PRP or DEQ to evaluate and update the individual site source control information at the completion of each major phase of the investigation. The primary purposes of screening include:

- Determining if site characterization is sufficient to support informed source control decisions;
- Identifying COPCs for the upland facility and each potential contaminant migration pathway; and
- Prioritizing sites for further remedial action or source control activities.

Once a potential contaminant migration pathway (*e.g.*, groundwater, direct discharge, or erodable soil) to the Willamette River is determined to be or reasonably likely to be complete in the future, representative contaminant concentrations for the specific migration pathway should be compared to the appropriate source control SLVs in Table 3-1 to identify site-specific COPCs.

The source control screening process needs to be formally documented at the completion of the upland RI or prior to this if a decision is made by DEQ that source control is necessary for a specific pathway. DEQ may require that the upland PRPs prepare and submit a site-specific Source Control Evaluation for review and approval as described in Section 7.0.

4.4 Source Control Prioritization

The DEQ will evaluate upland sites to determine the priority for requiring addition evaluation or implementing upland source control measures. Sites will be prioritized, based on potential threats to the Willamette River environment.

Source control prioritization may include an evaluation of the following key factors:

- Complete (known or potentially complete) contaminant migration pathway from the uplands to the Willamette River);
- Magnitude by which the SLV was exceeded and the number of contaminant exceedances for site-specific COPCs;
- Location, extent, and duration of SLV exceedances from COPCs;
- Presence of bioaccumulative chemical(s) in upland media or adjacent sediments;
- Presence of chemicals in upland media identified as potential risk drivers for the in-water RI/FS;
- Estimated magnitude of potential contaminant mass loading to the river;
- Presence of bioaccumulative chemicals(s) in aquatic tissue;
- Fate and transport behavior of the COPC; and
- Propensity of contaminant(s) to accumulate in sediments.

High-priority sites are expected to move forward with aggressive source control measures without delay or be subject to enforcement action. Medium-priority sites are expected to perform a weight-of-evidence evaluation process to determine if source control measures are required. Source control measures will not be required at low-priority sites unless determined necessary by the results of the Portland Harbor RI/FS or ROD(s).

DEQ, in consultation with EPA, will determine if source control is or is not required. In the event that a PRP does not agree with DEQ's determination that source control is required, the PRP can pursue the issue via dispute resolution as provided in DEQ's Portland Harbor Agreements or DEQ can take enforcement action in accordance with Oregon environmental regulations.

4.4.1 High Priority Source Control Sites

> **Immediate Source Control Measures**
>
> Actions that may be applicable to high priority source control sites include, but not be limited to:
>
> - Installing sorbent booms to address product seeps or spills.
> - Posting warning signs to prevent direct contact.
> - Removing product to control direct discharges to the river.
> - Removing accumulated sediments and debris from catch basins and storm water conveyance lines.
> - Hydraulic containment to control high concentration discharges to the river.
> - Bank stabilization efforts.

High priority source control sites are those facilities where DEQ and EPA determine that a complete contaminant migration pathway exists and the upland source is significantly impacting the river or poses a significant and imminent threat to the river based on an initial evaluation of the factors listed at the beginning of Section 4.4. A primary consideration is that one or more media significantly exceed applicable SLVs at the point of discharge to the river (*e.g.*, water at the end of a discharge pipe; soil or material at the riverbank) or the most reliable and cost-effective data point (*e.g.*, groundwater measured at the shoreline), or where a bioaccumulative chemical is detected at concentrations significantly above the SLV. In addition, if, at any point in the site characterization process, it is determined that an upland source is violating DEQ *narrative* water quality criteria[2] for the Willamette River, the site may be considered high priority. It should be noted that the detection of petroleum product (*i.e.*, dense or light nonaqueous phase liquid, DNAPL or LNAPL, respectively) in groundwater seeps along the riverbank or in the river are considered a violation of Oregon's narrative water quality criteria and are expected to initiate the immediate design and implementation of source control measures to control product releases to the Willamette River.

Sites identified, as high priority should move directly into evaluation of source control alternatives and source control implementation without delay. It is DEQ's expectation that sites identified as high priority for source control will initiate actions under DEQ's removal authority. The specific actions may parallel the CERCLA time critical or non-time critical removal path (EPA, 1993) as appropriate to select and implement source control. Source control should be implemented with little or no additional site characterization except as needed to define the extent of the problem and select or design an appropriate source control measure. The process for evaluation of potential source control measures is described in Section 4.6. The evaluation and design schedule should be developed to optimize source control implementation.

Source control measures implemented as interim actions will, to the extent practicable, contribute to the efficient performance of any long-term upland remedial action. Any interim action should be consistent with and not preclude implementation of an expected final remedy.

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[2] Oregon Narrative Water Quality Criteria OAR Chapter 340, Division 41 includes, but is not limited to prohibiting the creation of: 1) tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish; 2) objectionable discoloration, scum, oily sheen or floating solids or coating of aquatic life with oil film; 3) aesthetic conditions offensive to the human senses; 4) formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry; etc.

High priority source control measures will be discussed with the EPA and its partners as described in Section 6.0 and 7.0.

4.4.2 Medium Priority Source Control Sites

Medium priority source control sites are those facilities where DEQ determines that a complete contaminant migration pathway exists and the upland source is impacting the river or poses a significant and/or imminent threat to the river based on an initial evaluation of the factors listed at the beginning of Section 4.4. A primary consideration is that one or more media exceed applicable SLVs, but not significantly, at the point of discharge to the river, or where a bioaccumulative chemical is detected at concentrations above the SLV. Although exceedance of SLVs does not necessarily indicate a site poses a significant and/or imminent threat or needs to immediately implement source control measures, it does indicate that the site may pose a threat to human health or the environment and that additional evaluation may be needed to determine if source control measures are required to prevent, minimize or mitigate the migration of hazardous substances to the river. If the site exceeds one or more SLVs, the need for further characterization or for implementation of source control measures should be based on a site-specific weight-of-evidence determination.

The weight-of-evidence determination should be prepared by the PRP for agency review and approval. Detailed descriptions of the screening process and the weight-of-evidence criteria, by medium and pathway, are provided in Section 5.0. The weight-of-evidence evaluation should focus on upland evidence that a source is impacting, or may impact, the river. To determine if source control is needed, the evaluation of existing data or collection of additional data at the site should focus on the potential for:

- Ongoing release(s) based on the magnitude of the contamination source;
- Unacceptable impacts to the river based on the type(s), concentration(s), and number of contaminants;
- Contaminant loading to the river based on the nature of the contaminant and the presence of an environmental transport mechanism; and
- Propensity of contaminants to accumulate in Willamette River sediments.

Based on the weight-of-evidence evaluation, DEQ may decide, in consultation with EPA, that certain source control decisions should be performed in conjunction with specific in-water actions or deferred until such actions have been completed. In these cases, the results of the in-water characterization efforts, in-water early actions, or the in-water human health and/or ecological risk assessments may be required before the need for source control measures can be determined or adequately scoped.

Upland PRPs can elect at any time to proceed with source control at a medium priority site in lieu of performing additional investigation(s). Potential source control measures (*e.g.*, in-situ groundwater treatment; groundwater extraction; storm water management; removal of upland source materials; and natural attenuation) can be evaluated to determine if they would be adequate to ensure that the upland source does not represent a risk to human health or the environment, exceed ARARs, or represent and adverse effect on beneficial water uses.

Evaluation of available in-water sediment, bioassay, fish tissue or other in-water characterization data can be used to supplement the upland data in supporting the need for source control measures.

4.4.3 Low Priority Source Control Sites

Low priority source control sites are those facilities where upland data (*e.g.,* PA, SI, RI) indicate, based on an initial evaluation of the factors listed at the beginning of Section 4.4, the site likely poses a low threat to the river (*e.g.*, concentrations are near or below SLVs) or where DEQ, in consultation with EPA, may issue an upland "No Further Action" (NFA) determination or lower the State's priority of the site for further upland investigation or remedial action under DEQ's cleanup authority. These sites may be revisited following completion of the in-water risk evaluation and/or EPA Portland Harbor ROD(s).

4.4.4 Excluded Source Control Sites

Facilities where DEQ and EPA determine that there is no contaminant source or there is not a current or reasonably likely complete contaminant pathway to the river will be excluded from source control requirements.

4.5 Tools to Manage Sources

Upland source control is an iterative process, where early steps may be revisited and conclusions refined by information gathered later in the process. It may be most effective to use a combination of tools, to address a particular source, including but not limited to the following:

- *Technical Assistance*: Technical assistance, often provided during inspections, provides technical information tailored to help individual businesses bring their facility into compliance with pertinent regulations. DEQ's Hazardous Waste Program is actively providing technical assistance to facilities within the Portland Harbor Superfund Site.
- *Inspections*: An inspection (*e.g., hazardous waste compliance, storm water permit)* may help identify and control sources of chemicals at businesses and other facilities. Inspectors identify potential sources of chemicals of concern, document activities and sources on site, educate business representatives on the regulations, and offer technical assistance to help businesses comply with regulations. The right to inspect is typically written into federal, state, and local regulations to ensure that appropriate actions are taken at regulated facilities or activities. Inspections are often followed by administrative actions.
- *Administrative Actions/Enforcement*: Administrative actions include licenses, permits, deed restrictions, requirements for site development plans and enforcement actions. Agencies rarely take enforcement actions without first writing memos or letters to record inspection findings, document requested changes, and give warnings and offers of technical assistance. When enforcement actions are warranted, they are usually taken in escalating order, starting with notices of violation, then moving to enforcement or compliance orders requiring specific changes by a specific date, and finally to monetary

penalties. Formal cleanups performed under order or decree use oversight and enforcement to ensure that appropriate actions are taken in a timely manner.

- *Upland Contaminated Site Cleanups*: These are upland cleanups that address contaminated soil, groundwater, and storm water. Cleanup actions vary from site to site, and are typically implemented under Oregon environmental cleanup regulations, Resource Conservation and Recovery Act (RCRA), and/or Superfund authority. For the purposes of Portland Harbor source control, upland cleanups will focus on reducing or eliminating contaminant migration to the river.

- *Source Control of Active Discharges*: Tools to control active discharge include best management practices, industrial process changes, pollution prevention practices, and technology-based controls of effluent. Compliance is achieved voluntarily or through administrative actions, including permits or enforcement.

- *Storm Water Source Control*: Storm water source control is complex because discharges to storm drain systems are affected by many different sources (*e.g.*, land use activities, runoff from contaminated sites, and infiltration of contaminated groundwater into the storm drain system). It is also complex because storm water regulation may involve federal, state, and local agencies. Because of this complexity, all of the tools discussed above are useful for storm water source control and will be used as appropriate.

4.6 Source Control Alternative Evaluation and Design

As described above, the need for source control measures will be determined by DEQ, in consultation with EPA, based on a complete contaminant migration pathway, SLV exceedance(s), or other factors as appropriate. DEQ's RI Agreements with upland PRPs require source control measures to be performed as removal actions, or remedial actions, whichever can be completed to achieve source control by the time of the EPA Portland Harbor ROD(s) currently scheduled for 2008. "Removal actions" are interim cleanup actions that result in a significant reduction in the concentration, volume, toxicity or mobility of contamination. "Remedial actions" are final cleanup actions typically set forth in an upland DEQ ROD.

If DEQ determines that source control is required at a site prior to the completion of the upland RI, DEQ anticipates that the selection of the source control measure will be based on a focused feasibility study (FFS), developed in general accordance with the CERCLA Engineering Evaluation/Cost Analysis (EE/CA) process (EPA, 1993). If the need for source control is determined at the completion of the upland RI, the evaluation of source control alternatives will be incorporated into the upland feasibility study (FS). The site remedy will be selected by DEQ in accordance with OAR 340-122-0010 through 340-122-0115, in consultation with EPA and its partners, as described in Section 2.5.1.

For interim source control decisions, the EE/CA will consider how the source control measure may be integrated into a final remedy for the site and whether the source control measure would preclude implementation of future in-water remediation or additional source control measures.

Following DEQ approval of the EE/CA, the PRP should submit a remedial design document for review and approval prior to implementing the source control measure. The design should include a performance-monitoring plan to evaluate the effectiveness of the source control measure.

When it is determined that source control is required, EPA and partners, will be provided an opportunity to provide input on the source control measure including: the objectives; the evaluation and selection process; design; the implementation schedule; and the integration with the in-water RI/FS, as described in Section 2.5.1.

Source Control Alternative Evaluation

DEQ anticipates that the selection of the removal action will be based on a focused feasibility study or an Engineering Evaluation/Cost Analysis* (EE/CA) including, but not limited to the following:

- Site characterization -
  - Site description and background;
  - Potential sources;
  - Nature and extent of contamination;
  - COPCs
  - Previous removal actions;
  - Source Control Screening evaluation
- Identification of source control measure objectives -
  - Statutory limits;
  - Source control measure scope; and
  - Source control measure schedule.
- Identification and analysis of source control measure alternatives -
  - Effectiveness;
  - Implementability;
  - Cost.
- Comparative analysis of source control measure alternatives
- Recommended source control measure alternative.

Note: Prior to selecting and implementing source control activities, the DEQ project manager will prepare a brief staff report describing the proposed source control measure, publish a public notice, hold a public comment period, and consider public response in accordance with DEQ Cleanup Rules.

* Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA, December 1993. OSWER 9360.0-32FS. EPA/540/F-94/009.

4.7 Public Involvement

Public involvement requirements for source control decisions will be performed in accordance with state regulatory authorities used to implement source control. Public notices, comment periods, public meetings and presentations will be held with interested parties as appropriate to explain source control activities and plans and to supplement source information with local knowledge. Updates on source control activities will be included in DEQ or EPA fact sheets, newsletters, spreadsheets, or web-sites.

4.8 Confirming Source Control Measures are Protective

Completed upland source control measures will be documented in a Source Control Implementation Report. Once the Portland Harbor in-water risk evaluation has been completed and acceptable clean-up levels have been established for water and sediment, DEQ and EPA will re-evaluate upland source control decisions made prior to the EPA Portland Harbor ROD(s), as needed, to confirm whether upland sources have been controlled to levels that are consistent with cleanup requirements specified in the EPA Portland Harbor ROD(s). Depending on the timing of upland source control decisions, final source control determinations may be formalized in upland DEQ RODs, EPA Portland Harbor ROD(s), or other Source Control Decision documents. Facilities where source control is not implemented at the time of the EPA Portland Harbor ROD(s) may be included in the EPA Portland Harbor ROD(s) or it may be determined that further action is required for the upland source control measure to be protective of the river.

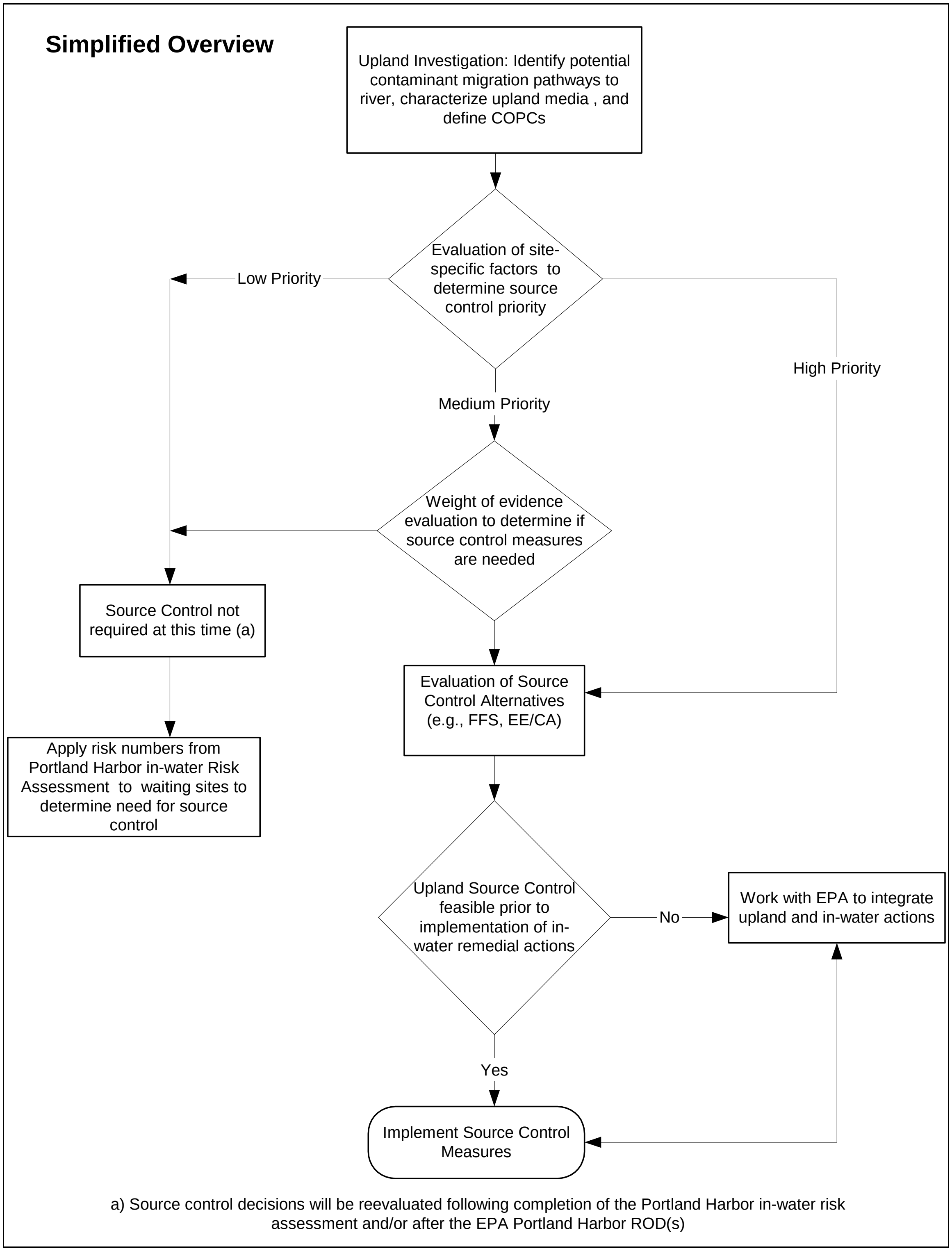

Figure 4-1 Source Control Decision Flow Chart

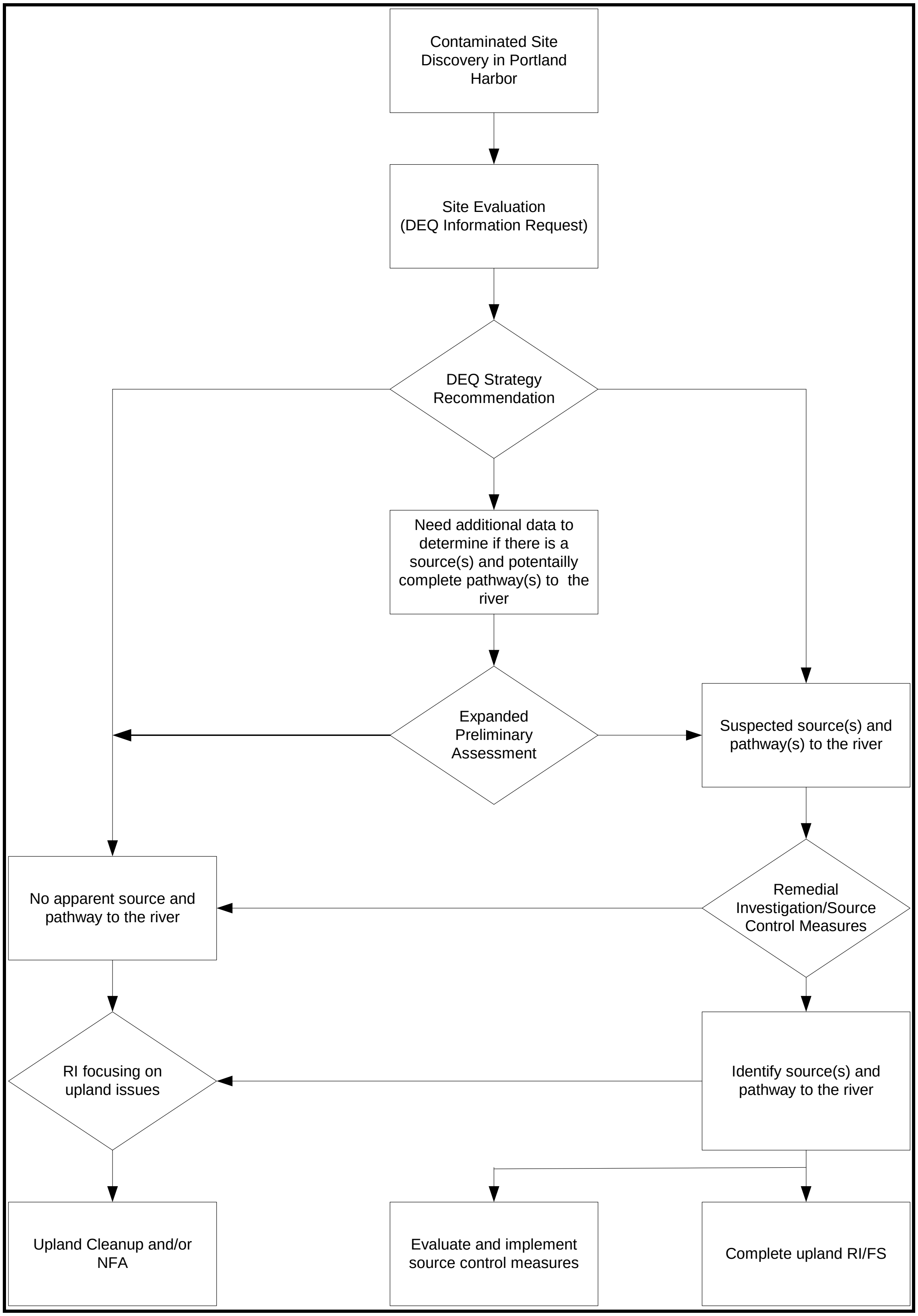

Figure 4-2 DEQ Upland Site Discovery and Evaluation Process Flow Chart

Section 5 Source Control Screening Process

This section describes the process for evaluating the need for source control measures for potential upland contaminant migration pathways to the Willamette River. As described in Section 4.0, the primary purposes of screening include:

- Determining if site characterization is sufficient to support informed source control decisions;
- Identifying COPCs for the upland facility and each potential contaminant migration pathway; and
- Prioritizing sites for further remedial action or source control activities.

DEQ may require upland PRP's to submit a site-specific Source Control Evaluation. The site-specific Source Control Evaluation should include screening (*i.e.*, comparison) of all available pertinent data (soil, groundwater, storm water, etc) to the SLVs developed in Section 3.0 and presented in Table 3-1. The screening process is intended to be iterative and applied throughout site characterization activities (*i.e.*, defining the nature and extent of upland contamination) and documented in the Source Control Evaluation.

Sites that significantly impact the river or pose a significant and imminent threat to the river will be designated as high-priority sites, as discussed in Section 4.4.1. A primary consideration for a high-priority site is that one or more media significantly exceed applicable SLVs at the point of discharge to the river (*e.g.,* water at the end of a discharge pipe; soil or material at the riverbank) or the most reliable and cost-effective data (*e.g.*, groundwater measured at the shoreline) and there is a known or likely complete contaminant migration pathway to the river. High-priority sites are expected to move forward with source control without delay. If a site exceeds one or more SLVs, but the exceedances are not significant, the site will likely be considered medium-priority, and the need for further characterization or for implementation of source control measures will be based on a site-specific weight-of-evidence evaluation. The weight-of-evidence evaluation should be included in the Source Control Evaluation prepared by the PRP for agency review and approval. DEQ will consider the weight-of-evidence and designate a source control priority level for a site.

Medium-priority sites should be evaluated using the weight-of-evidence criteria provided in the subsections below, categorized according to the contaminant medium and pathway at the site. The pathways of vessel traffic and air pollution are not discussed below, since they usually fall under one of the other pathways discussed below (*e.g*., upland air deposition that is carried to the river through storm water runoff will be considered under storm water screening). These pathways can be controlled with physical actions (source removal, BMPs, etc.) and/or administrative actions (orders, permits, etc.). The weight-of-evidence evaluation should focus on evidence that an upland source is impacting, or may impact, the river. Although this section provides acceptable approaches, alternative qualitative or quantitative approaches for evaluating these pathways may also be acceptable to the DEQ, EPA, and its partners.

5.1 Soil Screening

Contaminants in soil can migrate to the river as a result of:

- Wind erosion and entrainment of soil and subsequent deposition in the Willamette River. This erosion pathway is discussed in Section 5.1.1;
- Erosion of contaminated river bank soils or bank failure. This erosion pathway is discussed in Section 5.1.2;
- Soil contaminants leaching to groundwater and subsequently being transported to the river via groundwater flow is discussed in Section 5.1.3 and the groundwater pathway is discussed in Section 5.2; and
- Erosion of contaminated soil carried to the river via storm water runoff (*e.g.*, sheet flow, drainage ditches, storm water collection and discharge systems). The storm water pathway is discussed in Section 5.3.

5.1.1 Wind Erosion

While wind erosion is not likely a significant pathway during normal site operations, during remediation, development, or redevelopment activities, airborne contaminated soil, especially at sites adjacent to the river, could be a significant migration pathway. It is anticipated that short term remedial action implementation risks will be managed using site specific health and safety plans and DEQ approved work plans or soil management plans. This pathway is not considered a significant migration pathway and is not further considered in this document.

5.1.2 Erodable Surface Soils or Riverbank Material

Contaminants in erodable surface soil or in riverbanks pose a potential threat to aquatic receptors and river sediment. Specific numeric criteria have not yet been developed by DEQ or EPA to evaluate the potential impacts to human health or aquatic life from contaminated soil runoff to surface water or sediment. This section describes the general approach for screening these impacts.

Soil concentrations in erodable surface soil should be compared against the soil SLVs in Table 3-1 to assess the soil-to-sediment and soil-to-surface water pathways. If surface soil concentrations exceed soil SLVs, a qualitative or quantitative weight-of-evidence evaluation should be performed by the upland PRP to evaluate the likelihood of adverse effects from migration of soils to surface water and sediment and to determine if soils source control measures are required. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA and its partners in accordance with the MOU. The weight-of-evidence evaluation may include, but is not be limited to consideration of the following site-specific factors:

- Presence of persistent bioaccumulative chemicals;
- Contaminant concentrations (magnitude of exceedance above SLV);

- Regional background soil concentrations for naturally occurring chemicals (*i.e.*, metals);
- Extent of contaminated soil (*e.g.*, area of exposed and/or erodable soil);
- Proximity of source area soil to the river;
- In-water sediment data in proximity to source area;
- Site surface conditions (*e.g.*, exposed soil, paved, slope);
- Riverbank stability (*e.g*., potential for erosion under extreme rainfall events, potential for erosion under flood conditions, bank erosion rates);
- Soil properties (*e.g.*, soil type, compaction, erodability, permeability);
- Storm water management;
- Proximity of source area soils to storm water catch basins (See Section 5.3 regarding storm water);
- Evaluation of potential soil erosion and contaminant transport (*e.g.*, modeling, quantitative erosion calculations); and
- Estimate of potential contaminant loading to the river.

Source Control Measure
Example 1- Erosion Control

Erosion of contaminated riverbank soils directly to the Willamette River is a key transport mechanism for Portland Harbor. If riverbank soils significantly exceed SLVs, the responsible party will be required to evaluate and implement source control measures and may be required to perform in-water sediment sampling directly adjacent to the bank.

Source control measures should focus on removing contaminated soil or stabilizing riverbank soil to prevent erosion. Interim erosion control efforts may be needed to immediately reduce erosion potential, such as placing bales of hay, silt fences, or other types of materials to reduce erosion of contaminated soils.

Excavation/removal of contaminated soil significantly above SLVs is the preferred method for preventing erosion and transport of surface soils to the river. Capping with clean fill or revegetation may be appropriate source control measures or may be performed in conjunction with soil removal. Revegetation includes the planting of trees and shrubs, planting of native grasses with well-defined root structures, and temporary measures such as the placement of straw or binder materials to prevent erosion until root structures take hold. After planting, monitoring must be performed to ensure adequate planting densities are developed and the measure is effective. Berms or construction of engineered wetlands may also be incorporated into a source control measure.

The PRP is responsible for ensuring compliance with all local, state, and federal regulations during source control activities. For example, riverbank source control activities would likely be subject to the City of Portland's Greenway Code 33.440, which regulates shoreline development. The use of riprap is discouraged and may not meet City of Portland Greenway requirements or the need for habitat enhancement within Portland Harbor.

Near-shore shallow sediment sampling may be required to collect adequate data for source control measure design or to assess the priority and timing of potential source control measures. In general, the presence of product-stained or saturated soils immediately adjacent to the river, a storm water catch basin, or within an erosional channel may require source control measure implementation to prevent contaminants from reaching the river.

5.1.3 Subsurface Soils

> **Source Control Measure**
> **Example 2- Upland Source Removal**
>
> In some cases, source removal (*e.g.*, excavation of contaminated soil) is a source control measure. Source removal may be performed as a stand-alone measure or in conjunction with other source control measures such as erosion control or hydraulic containment. For example, erosion control efforts to address highly contaminated riverbank soils may not be effective. Similarly, measures to address groundwater contamination may not be effective without source removal. Contaminated soils with high concentrations (*e.g.*, hot spot or principal threat level) may require treatment or excavation and off-site disposal in a secure location.

Contaminants in subsurface soil may pose a potential threat to aquatic receptors and river sediment if contaminants are leached and transported to the river via groundwater flow. Specific numeric criteria have not yet been developed by DEQ or EPA to evaluate the potential impacts to human health or aquatic life from leaching of contaminated soil and migration to surface water or sediments. Therefore, due to the shallow presence of groundwater in the Portland Harbor Superfund Site, it is expected that focused groundwater sampling will be performed during site characterization activities and if groundwater impacts are identified they will be screened in accordance with Section 5.2. Subsurface soil remediation (*i.e.*, source removal) may be an effective way to achieve groundwater source control in conjunction with active source control measures (*e.g.*, hydraulic control, in-situ treatment) or when active source control measures are not effective in achieving source control objectives or do not appear cost effective. In some cases, source removal may be performed as part of the upland remediation necessary to protect upland receptors (*e.g.*, human or terrestrial ecological) and to meet DEQ's hot spot requirements.

A qualitative or quantitative weight-of-evidence evaluation should be performed by the upland PRP to determine if leaching of contaminated subsurface soil may impact groundwater quality in the future at concentrations exceeding groundwater or surface water SLVs and if subsurface soil source control activities are needed. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA and its partners in accordance with the MOU. The weight-of-evidence evaluation may include, but not be limited to consideration of the following site-specific factors:

- Presence of persistent bioaccumulative chemicals;
- Contaminant concentrations (magnitude of exceedance above SLV);
- Regional background concentrations for naturally occurring chemicals (*i.e.*, metals);
- Extent and distribution of contaminated subsurface soil;
- Depth to groundwater;
- Proximity of source area soil to the river;
- In-water sediment data in proximity to source area;
- Infiltration/leaching potential;
- Contaminant properties (*e.g.*, solubility, partitioning coefficients);
- Soil properties (*e.g.*, soil type, permeability);

- Available groundwater quality data; and
- Evaluation of potential soil leachability and contaminant transport (*e.g.*, modeling, quantitative calculations).

5.2 Groundwater Screening

Groundwater data obtained during each phase of site characterization activities should be used to screen potential impacts associated with groundwater discharge to the river. Screening should initially focus on groundwater in potential source areas, and then on groundwater downgradient from source areas as the plume is delineated. Information from the site should also be used to identify and investigate preferential migration pathways such as utility line backfill, storm water lines that discharge to the river, and permeable water bearing zones. DEQ's expectations for groundwater characterization for source control decisions are presented in Appendix C for informational purposes.

Upland groundwater data should be compared to ecological and human health water SLVs in Table 3-1. Exceedance of SLVs in groundwater at the site will trigger an evaluation using the factors listed at the beginning of Section 4.4 to determine the priority of the site for this pathway. If the pathway is determined to be high priority, then groundwater source control measures would be required at this site. For a medium-priority site, a weight-of-evidence evaluation will be conducted to determine the likelihood of adverse effects from migration of groundwater to sediment or surface water and to determine if groundwater source control measures are required. The detection of petroleum product (*i.e.*, DNAPL or LNAPL) in groundwater seeps along the riverbank or in the river are considered a violation of Oregon's narrative water quality criteria and may require the immediate design and implementation of source control measures to control product releases to the Willamette River.

Groundwater / Surface Water Characterization Considerations

The potential hydraulic connection between site groundwater and surface water should consider the following:

- ✓ Nature and extent of groundwater contamination.
- ✓ Characterization of groundwater discharge to surface water.
- ✓ Area of discharge (*e.g.*, width of discharge, length discharge interface extends into the river).
- ✓ Estimated groundwater discharge rate and volume.
- ✓ Location and estimated size of discharge (river bank seeps; near shore; river channel).
- ✓ Estimated contaminant loading to river.
- ✓ Contaminant fate and transport (including the propensity of a chemical to accumulate in or migrate through sediments).
  - ➢ Sediment characteristics (type, bulk density, porosity);
  - ➢ Contaminant characteristics;
  - ➢ Stability of sediments (*e.g.*, site hydrodynamics, dredging);
  - ➢ Sediment-groundwater partition coefficient;
  - ➢ Sediment-water sorption coefficient; and
  - ➢ Fraction of organic carbon in sediment.

Source Control Measure
Example 3- Groundwater Containment

Discharges of NAPL or sheen to the Willamette River will require hydraulic containment or control to prevent further releases to the harbor. Hydraulic containment may be required for contaminated groundwater that has an adverse effect on a beneficial water use or poses an unacceptable risk to human or ecological receptors. The design and implementation of hydraulic containment or control will require a thorough understanding of the groundwater flow regime, characterization of the contaminant distribution, and groundwater modeling. Options for hydraulic control include, but are not limited to, the installation of extraction trenches and barrier walls. Hydraulic containment or control through the installation of groundwater extraction wells along the Willamette River may be difficult due to the influence of the river on the groundwater flow regime.

The following steps provide a simplified approach for evaluating potential groundwater-to-sediment and groundwater-to-surface water pathways:

- Step 1: Screen groundwater concentrations against ecological and human health SLVs[1] presented in Table 3-1. Screening should be conducted at each groundwater monitoring well and groundwater data point.[2] Potential dilution should not be included in screening. As the site hydrogeologic conceptual model is developed and revised; appropriate groundwater data from within the plume (*i.e.*, area of groundwater exceeding SLVs[3]) and as close to the river as possible should be used to assess potential impacts to the river. The results of the SLV screening will be used to define the extent of groundwater contamination, to determine the need for additional source control evaluation, and ultimately to determine if source control is needed.

- Step 2: If a groundwater plume has not reached the river, install monitoring wells at the leading edge of the plume (*i.e.*, at an appropriate distance between the source and the river) to form an initial compliance boundary. These wells should be used to monitor plume stability and to allow the detection of contaminants in adequate time to initiate source control measures, if necessary. The initial compliance boundary will define the location at which exceedances of SLVs may trigger further evaluation of the potential for a complete groundwater transport pathway to exist in the future and therefore, require source control.

- Step 3: If groundwater concentrations exceed SLVs or other appropriate criteria a qualitative or quantitative weight-of-evidence evaluation should be performed by the responsible party to determine if source control or further investigation is required. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA, and EPA's

[1] Screening should be based on a site-specific hydrogeological CSM and a risk assessment exposure conceptual site model taking into account current and future land and water use. The CSM should be reviewed and updated at key decision points in the investigation. DEQ guidelines for CSM development are presented in Appendix C, for informational purposes.

[2] Screening should not be based on average concentrations or statistical derivation of exposure point concentrations determined over the discharge area of the plume, unless it is agreed by DEQ that there is adequate data available to do so.

[3] Groundwater plumes should be delineated in both plan view and cross-sectional view using SLVs or standard multipiers of SLVs (*e.g.*, 10x, 100x).

partners in accordance with the MOU. Specifically, the evaluation should address, but not be limited to, the following, as appropriate:

- Nature and extent of groundwater COPCs in each affected water-bearing zone;
- Potential presence of nonaqueous phase liquid (NAPL) or sheen;
- Presence of bioaccumulative chemicals;
- Magnitude of groundwater quality exceedance at each sampling point and the location of wells within the groundwater plume;
- Regional background concentrations for naturally occurring chemicals (i.e., metals);
- Stability of the groundwater plume (*e.g.*, predictive modeling);
- Fate and transport of groundwater COPCs;
- Estimate of potential contaminant loading to the river;
- Potential hydraulic connection between site groundwater and surface water and sediments;
- Consideration of available in-water data (*e.g.*, sediment, bioassay); and
- Potential for groundwater discharge to result in an accumulation in sediments above protective concentrations (*i.e.*, potential for groundwater discharge to result in sediment contamination or recontamination following sediment cleanup).

The portion of groundwater contamination retained on sediment is a function of the partitioning coefficient (K_{oc} for organics, K_d for metals) and the groundwater concentration (C_{gw}). The sediment concentration (C_{sed}) can predicted for screening purposes by the following relationship:

$$C_{sed} = (C_{gw}) \text{ X } (K_{oc} \text{ x } f_{oc} \ \underline{\text{or}} \ K_d).$$

Where:

C_{sed} = sediment concentration (mg/kg)
C_{gw} =groundwater concentration (mg/L)
f_{oc} = organic carbon fraction of the sediments
K_{oc} <u>or</u> K_d = partitioning coefficient (L/kg)

The equation can be rearranged to calculate the groundwater concentrations for a given sediment concentration and the associated partitioning coefficient:

$$C_{gw} = (C_{sed}) / (K_{oc} \ \underline{\text{or}} \ K_d).$$

If the equations listed above are used to screen the propensity of contaminants to accumulate in sediment, a discussion of the assumptions inherent in the equations and the uncertainty of results should be described in the Source Control Evaluation.

The weight-of-evidence evaluation should assess if the discharge of contaminated groundwater is likely to have an adverse affect on sediment, transition zone water, surface water quality, or exceed potential ARARs. In-water near-shore groundwater or transition zone water sampling may be required by EPA or DEQ in order to determine the nature and extent of contamination, collect adequate data for source control measure design, or to assess the priority and timing of potential source control measures. In general, the presence of DNAPL or LNAPL in groundwater wells immediately adjacent to the river will require source control measure implementation to prevent contaminants from reaching the river.

Data from the in-water characterization of groundwater discharges may be required to determine the need for or the adequacy of source control measures. If the groundwater discharge is likely to cause an adverse effect on beneficial water uses, source control measures are required. If the data are inconclusive due to confounding factors such as in-water sediment contamination or river dynamics, DEQ may defer, as described in Section 4.4.2 and 4.3.3, a source control measure decision until the results of the in-water characterization effort, in-water risk assessment, or any early action characterization activities are available to further evaluate the need for source control measures and to allow DEQ and EPA to integrate upland and in-water remedial actions.

5.3 Direct Discharge Screening

Pollutants from commercial, industrial, private, or municipal outfalls may be directly discharged to the Portland Harbor Superfund Site. Many of these discharges are permitted under the National Pollutant Discharge Elimination System (NPDES). Permitted discharges include industrial wastes, storm water runoff, and combined sewer overflows (CSOs). Direct discharges may consist of both a liquid (*i.e.*, whole water) and solid (*i.e.*, sediment) fraction.

Of the direct discharges, the most prevalent discharge in Portland Harbor is storm water. Storm water discharges within Portland Harbor are a mix of permitted and unpermitted discharges. In addition, storm water conveyances are a mix of publicly (*e.g.*, City of Portland, Port of Portland, Oregon Department of Transportation) and privately controlled systems. Privately controlled storm water systems should be evaluated by upland PRPs and the public conveyances should be evaluated by the appropriate public agency. Appendix D presents DEQ's guidance for characterizing catch basin sediments and storm water at upland sites within the Portland Harbor Superfund Site.

Storm water discharges are highly variable both in terms of flow and pollutant concentrations and the relationship between discharges and water quality can be complex. Based on the intermittent discharge periods and variability in pollutant and sediment loads associated with storm water, a conservative approach is used for screening. This approach is used to identify potentially significant or obvious contaminant sources to the river. Pollutant loading data are necessary to assess the cumulative effects on the river from various sources on a harbor-wide basis and to determine the relative contributions of individual sources.

Storm water discharges to surface water are fundamentally different than groundwater discharges to surface water. Groundwater discharges have the potential to exert toxic effects on the benthic community with little or no dilution. Piped storm water or sheet flow discharges have the potential to suspend and transport soil (including catch-basin or conveyance line sediment) into the river, especially during storm events. Particulates settling out of storm water discharges may represent a source of contaminant loading to river sediment, therefore cumulative sampling approaches may be required (*e.g.*, sediment traps). Additionally, contaminants in the whole water phase of storm water may partition in the river and add to the contaminant load to the river sediment.

Storm Water Characterization Considerations

- ✓ Proximity of potential contaminant sources to storm water catch basins.
- ✓ Nature and extent of surface soil contamination.
- ✓ Surface soil (0-1 foot below ground surface) concentrations within ~100 feet of a storm water catch basin or located within an area with a high probability or eroding and being transported to a catch basin.
- ✓ Permit status and compliance (*i.e.*, does the permit adequately assess potential site COIs?).
- ✓ Knowledge of site storm water system, including as-built maps showing catch basin and site discharge locations, catch basins drainage areas, and potential contaminant sources within each drainage basin.
- ✓ BMPs currently implemented.
- ✓ Adequacy of written storm water management plan.
- ✓ Effective catch basin design or catch basin improvements (*i.e.*, is the site catch basin specifically designed or modified to increase effectiveness in containing fine particulates or site specific contaminants?).
- ✓ Documentation of storm water system (*e.g.*, catch basin, lines, other structures) inspections and maintenance.
- ✓ Storm event criteria utilized for storm water discharge characterization (*e.g.*, samples should be representative of first flush and/or large storm events).

Effective storm water management is a key part of source control. The process described in the following sections applies to both permitted and unpermitted facilities. A groundwater assessment as described in Section 5.2 may also be necessary at a site if contaminated groundwater flow occurs within (infiltration/inflow) or along backfill of storm water pipes.

While DEQ environmental cleanup regulations provide a conditional exemption for permitted releases; the cleanup rules are applicable to the deposition, accumulation, or migration of contaminants resulting from otherwise permitted or authorized releases (OAR 340-122-030). Releases of hazardous substances as defined in 40 CFR 302 are not authorized for discharge under DEQ's state-wide general permit for storm water discharges (1200 z).

Storm water sediment (*e.g.*, catch basin, conveyance line) and storm water discharge (*i.e.*, whole water) sampling may be required at upland sites to characterize and evaluate the storm water pathway and to determine if source control measures are required to prevent contaminants from impacting the river and its sediments. Catch basin sampling provides a time-integrated sample of contaminants that may be or may have been transported to the river. Catch basin sediments may also be useful for source tracking purposes (*i.e.*, identify anomalous concentrations that may help locate the points of entry of significant loads within a drainage basin).

Depending upon site-specific conditions and the design of conveyance system, DEQ may require upland responsible parties to characterize sediments (*e.g.*, sediment traps, accumulated sediments) within private or shared conveyance lines and/or storm water discharge at the point of discharge (*e.g.*, outfall or connection to a shared conveyance system). Catch basin and storm water discharge sample analyses should be based on a comprehensive review of potential site-specific contaminant sources, available in-water sediment data adjacent to the site or discharge point, and other available data (*e.g.*, storm water conveyance line samples).

Storm water discharge,[4] including storm water sediment, data should be screened against the ecological and human health water and sediment SLVs presented in Table 3-1 to assess potential impacts to the river. As a first step, exceedances of aqueous storm water or storm water sediment SLVs may require implementation of BMPs. BMPs should be properly implemented on an ongoing basis to prevent contaminants from entering the storm water system. For example, the installation and maintenance of filters in catch basins to reduce particulate migration to the river. Storm water discharges that contribute to observed exceedances of narrative water quality criteria may require the immediate design and implementation of source control measures to control product releases to the Willamette River.

If subsequent storm water monitoring does not demonstrate an improvement in discharge quality, more aggressive evaluation and source control measures such as source removal, storm water system improvements, or storm water treatment may be required. If readily implementable BMPs are not effective in reducing storm water concentrations to below applicable SLVs, a qualitative or quantitative weight-of-evidence evaluation should be performed by the responsible party to determine if more aggressive storm water investigation and/or source control are needed. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA and its partners in accordance with the MOU. The weight-of-evidence evaluation should include the following site-specific factors:

- Identification and characterization (*e.g.*, type of release, area of release, size of release, age of release) of potential sources of contaminants;
- Magnitude of storm water and storm water sediment exceedance at each sampling point and proximity of sampling point to the river;
- Regional background soil concentrations of naturally occurring chemicals (*i.e.*, metals) for evaluating storm water sediment;
- Presence of bioaccumulative chemicals;
- Site hydrology including consideration of but not limited to the following:
    - Site conditions (*e.g.*, land use, surface conditions, topography);
    - Size of drainage (*e.g.*, outfall) basin; and
    - Location and estimated size of discharge (river bank; direct to river);
- Storm water system design (*e.g.*, catch basin design and effectiveness) and management (*e.g.*, BMPs, storm water management plan);
- Maintenance and condition of conveyance system (*e.g.*, frequency of catch basin and conveyance line cleanout);

[4] Samples should be collected in accordance with a DEQ approved work plan for catch basin sediment and storm water sampling, developed following DEQ's "*Framework for Portland Harbor Storm Water Screening Evaluations*" (DEQ, 2005) presented in Appendix E.

- Contaminant fate and transport (including chemical characteristics (*e.g.*, solubility, portioning coefficients), physical properties (*e.g.*, density, viscosity) of the COIs); and
- Estimate of potential contaminant loading to the river.

If the weight-of-evidence evaluation indicates that storm water is likely to have an adverse affect on water or sediment quality, near-shore sediment sampling[5] may be required in order to collect adequate data for source control measure design, or to assess the priority and timing of potential source control measures. Effects on sediment quality may be measured in sediment collected from below the storm water discharge point.

Data collected for evaluating the storm water pathway may be also be used by DEQ to determine if a storm water permit and storm water management plan are needed at the facility. In addition, storm water conveyance systems may represent potential preferential pathways for groundwater migration, both inside the pipe and in the fill material placed along the outside of conveyance pipes. Therefore, dry weather sampling of storm water conveyances may be required to evaluate this pathway. Section 5.2 describes the groundwater screening process.

Source Control Measure
Example 4- Storm Water Management

Storm water collection and discharge systems may be a significant pathway for contaminant discharges to Portland Harbor. Source control measures to address this pathway may include, but are not limited to:

- Implementation of BMPs to prevent material from entering the system;
- Removal or capping of contaminated surface soils;
- Storm water conveyance system upgrades and maintenance;
- Control of contaminant discharges to the river through treatment such as installation of oil-water separators; or
- Period catch basin cleaning and conveyance line flushing.

Best management practices should be used to address contaminant releases to the Willamette River from storm water discharges from Portland Harbor sites. Typical BMPs include, but are not limited to the following:

- Frequent sweepings to reduce the release of suspended solids that may have contaminants sorbed to them;
- Installation of drip pans;
- Regular cleaning of catch basins;
- Placement of erosion control devices around catch basins;
- Installation of secondary containment systems around hazardous material storage; and
- Management areas or other waste management activities.

[5] An understanding of river hydrodynamics in the vicinity of the discharge will be needed to locate samples and to evaluate their representativeness of the outfall discharges.

5.4 Overwater Activities

Overwater activities from some facilities (*e.g.,* docks, stationary barges) have the potential to release hazardous substances that could result in contamination or recontamination of the Portland Harbor Superfund site. Therefore, information regarding overwater operations and processes (*e.g.,* petroleum bulk loading, marine salvage, loading/unloading) that may result in release of contaminants to surface water or sediments of the Willamette River will be collected and evaluated during upland site characterization. Potential contaminant migration pathways (*e.g*., storm water discharges, spills, direct discharge from industrial processes) and contaminants of interest will be identified in the upland site characterization. The following steps provide a simplified approach for evaluating overwater activities that have a potential pathway to surface water or sediments:

- Identify potential overwater contaminant sources and contaminants of interest;
- Identify presence of any persistent bioaccumulative chemicals (*e.g.*, PCBs);
- Identify presence of treated (*e.g.,* creosote, pentachlorophenol) timbers, pilings, docks;
- Identify specific regulatory requirements or BMPs implemented for preventing contaminant releases or cleanup of spills (*e.g.,* permits, BMPs, spill plans); and
- Screen in-water sediment data in the vicinity of the overwater activity to assess whether observed contamination may be the result of overwater activity.

If the weight-of-evidence evaluation indicates that overwater activities are likely to have an adverse affect on water or sediment quality, BMPs or regulatory controls (permits, spill control and prevention plans) may be required to prevent or control future releases.

5.5 Source Control Measure Effectiveness and Completeness

Source control measures are expected to prevent or minimize the potential for sediment recontamination to occur, protect water quality, and to meet the other goals and objectives of the JSCS. Specific criteria to measure source control effectiveness will be developed in site-specific source control work plans and design documents. Monitoring (*e.g.*, periodic water quality sampling, confirmation/verification samples) will be required to demonstrate the effectiveness of interim or final source control measures. Once the in-water risk evaluation has been completed and acceptable clean-up levels have been established for water and sediment, DEQ and EPA may re-evaluate upland source control decisions to determine if they have the potential to recontaminate the sediment or otherwise inhibit achieving the long-term remedial action objectives for the Portland Harbor Superfund Site. If necessary, DEQ and/or EPA may require additional post-cleanup sampling of soils, surface water, groundwater, or sediments in order to evaluate source control effectiveness. Source control decisions and final source control determinations will be formalized in either DEQ upland Source Control Decision documents (*e.g*., upland DEQ ROD), with review and concurrence by EPA, or in the EPA Portland Harbor ROD(s).

The requirements of any necessary ongoing monitoring activities will be specified in site-specific monitoring plans developed as part of the source control measure or following implementation of the site remedy. Monitoring should be able to demonstrate that remaining contaminant concentrations meet the requirements for risk reduction and will not inhibit the achievement of ARARs applied to the in-water cleanup and established in the in-water Portland Harbor RI/FS. Monitoring to demonstrate the effectiveness of source control measures may include, but is not limited to the following:

- *Sediment Quality Monitoring.* Direct measurement of contaminant levels in sediments can be used to assess the overall effectiveness of upland source control measures. Monitoring can be used to determine if recontamination occurs, and if it does, at what rate and to what levels.
- *Storm Water or Other Direct Discharge Monitoring*. Types of monitoring that can be used include monitoring of near-shore sediment, storm water discharge, catch basin sediments, sediment traps, and storm water conveyance line sediments. The monitoring program can be designed to assess and/or demonstrate the effectiveness and completeness of upland storm water source control measures (*e.g.,* BMPs, capping). In shared storm water conveyance systems, this information can be used to track and identify sources of chemicals of concern to in-water sediments and to evaluate whether source contributions have changed either as a result of source control measures or due to changes in businesses operating in a basin.
- *Groundwater Monitoring*. Groundwater quality monitoring or elevation monitoring can be used to demonstrate the effectiveness of groundwater source control measures. The monitoring program can be designed to assess and/or demonstrate the effectiveness and completeness of upland groundwater source control measures (*e.g.,* hydraulic containment, natural attenuation, barrier wall).
- *Pollutant Loading Calculations*. Estimating mass loading and reductions in mass loading may be required to demonstrate source control effectiveness. In addition, loading estimates may be needed to assess the cumulative effects on the river from various sources on a harbor-wide basis and to determine the relative contributions of individual sources.

Source control for upland Portland Harbor sites may be considered complete when sources of contaminants to the river are identified and controlled, to levels determined to be protective of human health and the environment in the EPA Portland Harbor ROD(s), through either physical actions (source removal, containment, BMP implementation, etc.) or administrative actions (orders, permits, etc.). Source control decisions and effectiveness will be documented and approved by DEQ and provided to EPA and partners for review and comment.

For confirmed upland sources that discharge to the river, source control may be considered complete when DEQ and/or EPA determine that site management and other source control measures have been implemented to prevent or minimize the potential for recontamination of sediments and otherwise achieve the long-term remedial action objectives for the Portland Harbor Superfund Site. The “completeness” determination for upland sources may also be based on the successful use of appropriate tools (*e.g.*, modification or issuance of permits or orders to implement long-term monitoring, BMPs, the establishment of effluent limitations, or other appropriate controls and/or monitoring (*e.g.*, sediment, direct discharges, soil, groundwater)) to confirm that contaminant sources have been controlled.

Source control efforts should be documented and evaluated to determine whether these actions prevent or minimize recontamination of sediments above the Portland Harbor cleanup goals to be set in the EPA ROD(s). Given the complexity of storm water sources and discharges, source control efforts will involve coordination between the federal, state, and local agencies with regulatory authority and responsibility to control storm water sources.

Section 6 Upland Source Control Schedule

As stated in Section 1.0, the **overarching goal** of the JSCS is to identify, evaluate, and control sources of contamination that may impact the Willamette River in a manner that is consistent with the objectives and schedule for the Portland Harbor RI/FS; the EPA Portland Harbor ROD(s) is currently planned for completion in 2008. DEQ's Environmental Cleanup Program will oversee PRP investigations and source control evaluations on upland sources of hazardous substances to the Willamette River. There are currently over 60 upland investigations and cleanups underway within the harbor. Upland site investigations are in various phases from agreement negotiation to source control measure implementation. Portland Harbor upland sites can be divided into the categories listed below, based on DEQ's site cleanup process[1].

DEQ will provide EPA with a detailed schedule for completing upland site discovery, characterization and screening, evaluation and implementation of upland source control measure decisions. This schedule will be updated in quarterly milestone reports (see Section 7.0), based on the progress of the in-water RI/FS and DEQ source control efforts.

- **<u>Portland Harbor Site Discovery</u>**: DEQ initiated an extensive Portland Harbor site discovery program in 1998 and continues to identify potential sources of contaminants to the river through its Site Assessment (SA) Program. Initial screening activities focused on sites along the banks of the Willamette River. Upland site discovery activities in the Portland Harbor Superfund Site are ongoing (see Appendix B for additional information on DEQ's site discovery processes) and will continue to identify additional upland sources of contamination. Currently, site discovery activities are primarily focused on facilities discharging storm water to Portland Harbor via private or shared storm water conveyance systems. If it is determined, based on site discovery activities, which a site is a potential source of contamination to the river, the schedule for characterization and evaluation of source control measures will be determined based on the results of the initial site evaluation.

- **<u>Preliminary Assessments (PA)</u>**: These are sites that are identified during DEQ's site discovery process. The results of the PA are used to determine if a site is a potential source of contamination to the river. For sites determined not to be a likely source of contamination, these decisions may have to be re-evaluated, based on the results of the in-water Portland Harbor RI and risk assessment. For sites determined to be a likely source of contamination to the river, further investigation will be conducted under DEQ oversight, the schedule for characterization will be determined on a site-by-site basis.

- **<u>Expanded Preliminary Assessments (XPA)</u>**: These are sites where the DEQ site discovery process determined that additional information was needed to decide if they are a current or likely future source of Portland Harbor contamination. Based on the

[1] Appendix B presents DEQ's cleanup process for informational purposes.

results of the XPA, these sites may be recommended for an upland RI or source control measures, or it may be determined that source control is not needed.

- **<u>Remedial Investigations</u>**: These sites range from those where the upland RI was initiated by DEQ prior to the NPL listing of Portland Harbor to those RIs initiated in 2000/2001 following DEQ's 1999/2000 site discovery activities. These sites are generally the most contaminated and complex. Characterization of upland sources and pathways is near completion for many of these sites.

- **<u>Source Control Screening/Evaluation</u>**: Informal source control screening and evaluation will be conducted iteratively throughout each phase of the upland investigations. Once sufficient data exist to assess a specific contamination migration pathway, the key factors described in Section 4.4 will be considered to prioritize the site and either source control measures will be implemented or the need for further evaluation identified. The schedule for screening and evaluation will be site specific.

- **<u>Source Control Measures</u>**: The success of the Portland Harbor cleanup relies on the timely and successful implementation of upland source control measures. Ideally, upland source control should be completed to the extent practicable prior to sediment cleanup in the Portland Harbor Superfund Site. Since the schedule for the Portland Harbor project currently calls for an EPA Portland Harbor ROD(s) in 2008, adherence to the schedule and processes in this JSCS are critical to successful upland source control. Depending on the timing of source control decisions, final source control determinations may be formalized in either upland DEQ ROD(s) or in the EPA Portland Harbor ROD(s).

  The focus for completing source control decisions will be on high-priority sites and early actions. High-priority sites will be identified in the initial Milestone Report based on existing site information, and subsequent Milestone Reports will identify any new high-priority sites as new information becomes available (milestone reporting is described in Section 7.4). Source control is expected to move forward at high-priority sites without delay. The target for addressing medium-priority sites is prior to the EPA Portland Harbor ROD(s) in 2008. Once the in-water risk evaluation has been completed and acceptable cleanup levels have been established and ARARs are identified for water and sediment, DEQ and EPA will re-evaluate completed source control decisions and revisit medium- and low-priority sites where a source control measure was not taken to determine if further source control is necessary. High, medium-, and low-priority sites are defined in Section 4.4.

Section 7 Source Control Documentation and Tracking

DEQ has responsibility for ensuring that upland site investigations and source control decisions are properly documented. DEQ also has responsibility for tracking the overall status of upland source control activities. DEQ will transmit source control documentation and tracking information to representatives of EPA and other governmental parties on the TCT for information sharing or concurrence to ensure coordination with work in the river where EPA has responsibility, as described in Section 2.5 and in this section.

This section describes the documentation needed to support source control decisions and the spreadsheets used to track source control status; the basic environmental data included in documents and databases; and the type and frequency of the presentation of these materials and the expected level of response. The purpose of describing coordination of source control information is to provide DEQ with the autonomy to conduct source control as agreed under the MOU, and avoid duplication of effort in review of source control data and limit re-work of source control documents. Concurrence from the representatives of EPA and other governmental parties on the TCT on pertinent source control documents will provide DEQ with assurance to move forward with source control decisions. Setting up a clear process of source control documentation, tracking, and review will aid EPA in making appropriate and timely sampling and cleanup decisions in the river.

If EPA comments on plans and reports identified for review are not addressed satisfactorily in a revised document, EPA and DEQ management involvement may be required to reach closure on the issue. All attempts should be made to resolve comments at the staff level through clarification during TCT conference calls, which are typically held every other week, or source control-specific meetings prior to finalization of documents.

7.1 Upland Source Control Decision Documentation

In general, upland site characterization activities will follow the CERCLA process outlined in DEQ (see Appendices B and C) and EPA guidance documents. DEQ may require the PRP submit a site-specific Source Control Evaluation that will be used to prioritize the site (*i.e.,* high, medium, and low) and complete a Source Control Decision document. The Source Control Decision document may be developed by DEQ or the upland PRP following completion of the upland RI, or earlier if DEQ determines that sufficient information exists to initiate source control immediately or make a source control decision. DEQ will determine the adequacy of Source Control Evaluation and Decision documents prepared by the upland PRP.

DEQ will submit the Source Control Decision document to EPA's source control contact and interested representatives of other governmental parties on the TCT for review and comment. Written comments on a report should be transmitted to DEQ within 30 days of document receipt unless the parties agree to an alternative review period. Subsequent document revisions should be provided in a format (e.g., redline/strikeout) for ease of review. DEQ should consider augmenting the written report with a site tour or visual presentation for sites that are unusually complicated or of high importance.

7.1.1 General Information

A list of basic environmental information presented in the subsections below will be included in a Source Control Decision document, if applicable. The list of requested information should limit re-work of reports because the requested data reflect shared expectations of document content. The requested information is organized under general information as well as categories for specific affected media, including groundwater and storm water. If the upland RI determines that some or all environmental media are not a source concern, the report should describe historical documentation or more recent sampling results that demonstrate the conclusion for the items in each media category. Reports should be concise yet provide enough site description, figures, and analytical data to support a source determination through review of the report alone without the need to visit extensive referenced documentation.

Source Control Decision documents should be completed following a thorough investigation and evaluation of an upland site, and subsequent source control activities should begin in a timely manner. New sources or a new understanding of existing sources may be discovered through information such as recently acquired historical documentation, ongoing environmental monitoring results, or the results of the in-water risk assessment. New information may lead to initiation of source control activities or modification of an existing source control decision.

Source control decisions may encompass a broad range of remedial actions ranging from no further action (NFA) to interim remedial measures (IRMs) to final upland remedial actions (*i.e.*, upland DEQ RODs). DEQ or the upland PRP will prepare a Source Control Decision document, as described below, that presents the recommended source control decision and provides the technical basis for the decision. Source control decisions may include, but are not limited to, the following:

- Determination that a facility is not a current source of contaminants to the river;
- Determination that source control for a specific contaminant migration pathway is not needed (*i.e.*, weight of evidence evaluation, COPC loading estimate);
- Approval of the scope of work for in-water source control investigations;
- Concurrence on source control prioritization and/or implementation schedule;
- Request for comments on proposed source control measures (EE/CA) or design; Approval of source control measure selection;
- Approval of proposed source control design and implementation schedule; and
- Determination that a source control measure is effective and complete and that the facility is no longer a current source of contaminants to the river.

In order to streamline the Source Control Decision document review process and to facilitate information sharing, a general framework is outlined below. The following outline should be modified as appropriate to support the site-specific source control decision. The Source Control Decision document may be developed in memorandum, letter, or report format as appropriate for the amount of information supporting the determination. The Source Control Decision document should include a summary of the following information.

1. **Introduction**: including a statement of source control decision to be approved by DEQ.
2. **Site Description and History:**
    a. List historical and current site operations (*e.g.*, land use, operations, etc. to late 1800's);
    b. Identification of potential current and historic upland contaminant sources (*e.g.*, buildings, rails, tanks, spills, dry wells, drainage ways, catch basins, outfalls, sewer lines, storm water lines, other pipelines, septic tanks, trenches, lagoons, industrial processes);
    c. Identification of contaminants of interest associated with current and historic activities;
    d. Identification of potentially contaminated media (*e.g.*, soil, groundwater, storm water, surface water, air);
    e. Identification of site structures or BMPs that could prevent or minimize contaminant mobilization such as the location of paved areas or covered storage areas; and
    f. Identification of complete or potentially complete contaminant migration pathways from upland sources to the river.
3. **Regulatory History:**
    a. Description of regulatory history;
        i. Regulated tanks (above and below ground);
        ii. Hazardous waste management:
            - RCRA Generator Status,
            - Inspections, and
            - Reporting;
        iii. Permits (storm water, solid waste, air, other);
    b. Violations;
    c. Pollution Complaints/Spills; and
    d. Cleanup Status (voluntary, enforcement, etc.).
4. **Hazardous Substance Releases**:
    a. Description of all known releases; and
    b. Summary of previous environmental investigations and cleanups including a description of material left in place; current and historic monitoring data; and frequency of sampling events.
5. **Source Control Evaluation**:
    a. Description of nature and extent of contamination focusing on source areas, contaminants, and exposure pathways.

    b. Summary of soil, groundwater, storm water, surface water, and sediment data.
    c. Comparison of environmental data to SLVs for each applicable pathway.
    d. Identification of media and pathways exceeding SLVs.
    e. Identification of site COPCs (109).
    f. Priority for source control.

6. **Summary of Source Control Decision**:
    a. A description of the recommended source control decision.
    b. Summary of comparative analysis of source control measure alternatives.
    c. A discussion of the source control measure objectives and tools that will be used to control sources.
    d. An estimate of expected risk reduction or contaminant loading to the river.

Appropriate site maps or figures should be included as needed to support the decision. Appropriate maps may include, but are not limited to:

- Site location map showing proximity to the Willamette River and adjacent sites;
- Map of current and historic upland contaminant sources;
- Storm water drainage map;
- Sample location maps;
- Contaminant distribution maps for selected COPCs;
- Geologic cross sections; and
- Groundwater elevation maps.

Tables (with clear units of measure) needed to support the source control decision should be included in the report. Tables summarizing environmental data and comparing the data to appropriate source control SLVs should be included.

Other applicable information, such as boring logs, well screen depths, analytical data, design drawings, aerial photographs, etc., should be included as needed to fully support the source control decision. (See Appendix B and Appendix C, for further consideration of types of data or analyses that may be included). The following sections list pathway specific information that may be needed to support a source control decision.

Upland Source Control Decision documents should provide a list of key plans and reports, and can summarize or reference reports, letters, or memorandum that are available in the site Administrative Record or the "*Site Summary Report*" prepared by the LWG (LWG, 2004a and 2004b) for the in-water Portland Harbor RI, if available. Full citations for reports supporting the source control decision must be provided.

7.1.2 Pathway Specific Information

Section 5.0 identifies pathway specific information that should be considered when making source control decisions. This information should be included in the Source Control Decision document as needed to support the decision being made by DEQ. The following sections provide lists of medium-specific information that should be included in Source Control Decision documents if the medium is contaminated at a site.

7.1.2.1 Groundwater

- Describe the nature and extent of groundwater contamination, including a description of contamination levels at the leading edge of a plume and a determination about whether the contamination reaches the river or could potentially reach the river.
- Provide a figure depicting the hydrogeologic cross-section to summarize the relationship of sources, formations, groundwater, and surface water.
- Describe the area of discharge, including the discharge width and the length that the interface extends into the river.
- Describe the location and estimated character of discharge such as through river bank seeps or a river channel.
- Estimate the potential groundwater discharge rate (*i.e*., flux) and contaminant loading to the river.
- Explain potential contaminant fate and transport, including the propensity of a chemical to accumulate in or migrate through sediments.

7.1.2.2 Storm Water

- Describe the nature and extent of contamination at the ground surface or subsurface draining to the catch basins or other conveyances to the storm water system.
- Present a figure or as-built map of on-site capture of storm water, including catch basin and outfall locations, catch basins drainage areas, and potential contaminant sources within each drainage basin.
- Report storm water sampling results, including sampling for baseline discharge, representative storm events, BMP effectiveness, and sediment sampling in conveyances and below outfalls.
- Describe the adequacy of the written storm water management plan.
- Explain if BMPs at the site are currently implemented.
- Document catch basin inspections and maintenance.
- Describe effective catch basin design or catch basin improvements, including catch basin specifically designed or modified to increase effectiveness in containing fine particulates or site-specific contaminants.

- Estimate the potential storm water discharge volume and contaminant loading to the river.

7.1.2.3 Soil

- Describe the nature and extent of soil contamination including contamination levels and a determination about whether the contamination reaches the river or could potentially reach the river.
- Provide a figure(s) depicting the horizontal and vertical extent of soil contamination in map and cross-sectional view to summarize the relationship of sources, soil type, groundwater, and surface water.
- Explain potential contaminant fate and transport, including the likelihood of soil contaminants transported by storm water or wind erosion or by leaching.
- Estimate the potential contaminant loading to the river from direct erosion or bank wasting.
- If soil erosion by storm water is the primary soil transport mechanism, refer to Section 7.1.2.

7.2 Source Control Tracking

7.2.1 DEQ Source Control Tables

DEQ will prepare, maintain, and periodically update a table containing a summary of the status of upland investigations and source control decisions. DEQ will notify the TCT when updates have been made and include the date of update in the table. DEQ will periodically prepare and update tables containing the following information.

- List of potential upland sources including:
    - Name/address of source;
    - River Mile;
    - DEQ Environmental Cleanup Site Information (ECSI) Database File Number;
    - Identification of potential contaminant migration pathway;
    - Status of Source Control Evaluation;
    - Source control priority designation;
    - Status or Source Control Decision document;
    - Status of source control design and implementation;
    - Status of Source Control Implementation Report; and
    - Other: remarks or outstanding issues (monitoring, institutional controls, etc.).
- List of key site characterization or source control documents received for upland sites.

These tables are posted on DEQ's Portland Harbor Website:

> http://www.deq.state.or.us/nwr/PortlandHarbor/ph_background.htm

7.2.2 DEQ Environmental Cleanup Site Information Database

DEQ will provide site information and status in the ECSI database. ECSI is available online at: http://www.deq.state.or.us/wmc/ecsi/ecsiquery.htm.

7.3 Source Control Implementation Reports

Completed upland source control measures are expected to be documented in a Source Control Implementation Report and submitted to DEQ for review and approval. DEQ may require the upland PRP to prepare a report that presents: a summary of the source control implementation (*i.e.,* construction report); demonstrates the effectiveness of the source control measures; and evaluates the completeness of the source control measures. DEQ will provide the report or a summary of the report to the EPA source control contact and interested representatives of other governmental parties on the TCT for review and concurrence. These reports may be developed in memorandum, letter, or report format as appropriate for the amount of information supporting the effectiveness and completeness determinations.

DEQ and/or EPA may make one of the following determinations:

- A final source control determination may be made when the source control measure has been fully implemented and its effectiveness documented to achieve the clean-up levels established for water and sediment in the EPA Portland Harbor ROD(s).
- For medium- and low-priority sites where the weight-of-evidence evaluation determines that no further source control measure is needed, a final source control determination may be needed to confirm whether upland source control is needed or whether sources have been controlled to levels that are consistent with cleanup requirements specified in the EPA Portland Harbor ROD(s).

The Source Control Implementation Report should contain and address the following, as appropriate:

- Description and discussion of the nature of contamination and pathway(s) to the river.
- Description of source control implementation or construction;
- Regulatory or other tools used for source control, including monitoring.
- Map(s) of the site or storm water basin(s).

- Criteria relevant to determining source control effectiveness and completeness for the source/area, including but not limited to:
    - Upland site cleanup information,
    - Surface water or sediment quality information,
    - Other potentially applicable criteria.
- Chronology of site to include:
    - Occupancy and operations conducted on the site.
    - Environmental actions taken to date.
    - Steps taken for further source characterization and control.
    - Sampling events for data used to support this determination.
- Data used to support the effectiveness/completeness determination and noted on the site chronology, either as appendices to the report or summarized in tables.
- Full citations for data and other reports/information supporting determination of effectiveness.
- Estimates of the volume, weight, cost, etc. of contaminants removed, contained, treated or otherwise controlled to assist in communicating progress of source control work to stakeholders.
- Estimate of contaminant loading to the river following the source control measure and an estimate of the reduction in contaminant loading.

7.4 Milestone Reports

The MOU requires the preparation of Milestone Reports on a quarterly basis. The milestone reports will be submitted to EPA by DEQ and will summarize the status of DEQ efforts to identify and control sources of contamination to the Portland Harbor Superfund Site. The Milestone Reports will support quarterly meetings with representatives of EPA and other governmental parties on the TCT that cover site prioritization and source control progress. The meetings will focus on resolving issues at high-priority sites as defined in Section 4.0. These reports will serve as documentation of progress on river-wide source control. The first Milestone Report will be submitted to EPA 90 days following signature of this JSCS by EPA and DEQ.

Milestone Reports will include the information contained in the following sections, as appropriate.

7.4.1 Potential Identified Sources

DEQ is evaluating and identifying potential upland sources of contamination to Portland Harbor to determine if further investigation or source control measures are required. DEQ will present a table of potential upland sources identified through upland site discovery activities (see Appendix B for more information) and the status of their review.

7.4.2 Source Control Evaluation

Preliminary investigation activities at upland sites are designed to determine if a site is an ongoing source of contamination to the river. Sites that are identified as current or potential sources will be characterized and prioritized, and then may require either initiation of source control measures or further evaluation to determine if source control measures are required. DEQ will present a table of confirmed sources of contamination to the river, the basis for that determination, and the priority of the site for source control. High-priority sites will be identified in the initial Milestone Report based on existing site information, and subsequent Milestone Reports will identify any new high-priority sites as new information becomes available. Source control is expected to move forward at high-priority sites without delay.

7.4.3 Source Control Decision

Source control decisions conducted at upland sites will briefly summarized. The Milestone Reports will include a summary of the source control evaluation, the basis for determination that upland source control measures are necessary, a summary of the selected source control measure, and a schedule for implementation of the source control measure. DEQ will present a table of the source control decisions for each contaminant migration pathway for confirmed or potential sources of contamination to the river.

7.4.4 Status of Ongoing Source Control Measures

For ongoing source control measures, a summary of their status will be provided in the Milestone Reports. The status report will summarize activities completed to date, proposed activities, and a target schedule for completion. To the extent practical, DEQ will collect information and/or make estimates of the mass or volume of contaminants removed, contained, treated or otherwise controlled, in order to help communicate to stakeholders on the progress of source control activities.

7.4.5 Completed Source Control Measures

A summary of completed source control measures will be provided in the Milestone Reports. The status report will provide a description of the source control measure, the date the source control measures was completed, the date of EPA review and comment, and any operation and maintenance requirements.

7.4.6 Source Control Measure Issues

DEQ will identify issues affecting the ability to make source control decisions or completeness determinations, for any step of the source control process (i.e., identification, characterization, and implementation). In addition, DEQ will propose ways to resolve issues and a desired timeframe for resolution.

7.4.7 Source Control Measure Schedule

DEQ will provide the source control schedule and quarterly updates to the schedule (See Section 6.0) in order of site priority. The schedule will list the site name, priority, known contaminant migration pathways, status of source control documents (i.e., Source Control Evaluation, Source Control Decision, Source Control Design; and Implementation Report). Target dates that have changed will be listed and an explanation for the change will be provided.

Section 8 References

8.1 State and Federal Guidance

DEQ, 1998a. *Guidance for Conduct of Deterministic Human Health Risk Assessments*. Waste Management and Cleanup Division, Portland, OR.

DEQ, 1998b. *Guidance for Use of Probabilistic Analysis in Human Health Risk Assessments*. Waste Management and Cleanup Division, Portland, OR.

DEQ, 1998c. *Guidance for Ecological Risk Assessment: Levels I, II, III, and IV*. Waste Management and Cleanup Division, Portland, OR.

Section	Last Updated
LEVEL I Scoping	11 / 98
LEVEL II Screening	12 / 01
LEVEL II Screening Benchmark Values	12 / 01
LEVEL III Baseline	03 / 00
LEVEL IV Field Baseline	11 / 98

DEQ, 2003. *Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites*. September 2003. Oregon Department of Environmental Quality, Portland, OR.

EPA, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Interim Final. October 1988. EPA/540/G-89/004. OSWER Directive 9355.3-01.

EPA, 1989. *Ecological Assessment of Hazardous Waste Sites: A field and laboratory reference*. Envir. Res. Lab. Corvallis, OR. EPA/600/3-89/013.

EPA, 1989. *Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual - (Part A)*. Interim Final. December 1989. OSWER Publication EPA/540/1-89/002.

EPA, 1990a. *CERCLA Compliance with Other Laws Manual: CERCLA Compliance with the CWA and SDWA*. OSWER Publication EPA/9234.2-06/FS. February 1990.

EPA, 1990b. *ARARs Q's & A's: Compliance with Federal Water Quality Criteria.* OSWER Publication EPA/9234.2-09/FS. June 1990.

EPA, 1990c. *ARARs Q's and A's: State Ground-Water Antidegredation Issues*. OSWER Publication EPA/9234.2-11/FS. July 1990.

EPA, 1991a. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*. OSWER Directive 9285.6-03.

EPA, 1991b. *ARARs Q's & A's: General Policy, RCRA, CWA, SDWA, Post-ROD Information, and Contingent Waivers*. OSWER Publication EPA/9234.2-01/FS-A. July 1991.

EPA, 1991c. *ARARs Q's & A's: Compliance with New SDWA National Primary Drinking Water Regulations for Organic and Inorganic Chemicals*. OSWER Publication 9234.2-15/FS. August 1991.

EPA, 1991d. *A Guide to Principal Threat and Low Level Threat Wastes*. OSWER Publication 9380.3-06FS. November 1991.

EPA, 1993. Conducting *Non-Time-Critical Removal Actions Under CERCLA*. EPA, December 1993. OSWER 9360.0-32FS. EPA/540/F-94/009.

EPA, 1994a. *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates*. Office of Science and Technology, Washington, D.C.

EPA, 1994b *Catalogue of Standard Toxicity Tests for Ecological Risk Assessment*. Office of Solid Waste and Emergency Response. ECO Update, Volume 2, Number 2. EPA 540-F-94-013.

EPA, 1997a. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Interim Final. June 1997. OSWER Publication EPA 540-R-97-006.

EPA, 1997b. *Supplemental Ecological Risk Assessment Guidance for Superfund*. EPA Region 10, Seattle, WA. EPA 910-R-97-005.

EPA, 1998a. *Portland Harbor Sediment Investigation Report, Multnomah County, Oregon*. Region X, Seattle, Washington. Document Control No. 04000-019-036-AACE. DRAFT

EPA, 1998b. *EPA's Contaminated Sediment Management Strategy*. OSWER Publication EPA-823-R-98-001. April 1998.

EPA, 1998c. *Guidelines for Ecological Risk Assessment*. OSWER Publication EPA/630/R-95/002F. April 1998.

EPA, 2000a. *Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates*. Second Edition. March 2000.

EPA, 2000b. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates*. Second Edition. March 2000.

EPA, 2004. *Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods*. OSWER Publication SW-846 (sixth revision), November 2004 and subsequent updates.

8.2 Screening Level Values:

EPA, 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Interim Final. Office of Solid Waste and Emergency Response. EPA 540-R-97-006.

DEQ, 2001. *Guidance for Ecological Risk Assessment: Level II Screening Benchmark Values*. Waste Management and Cleanup Division, Portland, OR. Updated December 2001.

DEQ, 2004. *Water Quality Criteria Summary.* Table 20. Oregon Administrative Rules, Chapter 340, Division 041 - Department of Environmental Quality

DEQ, 2005. *Water Quality Criteria Summary Tables 33A, 33B, and 33C*. AWQC based on the acute and chronic freshwater aquatic life criteria in Table 33A and C, which is an update of OAR 34-41 Table 20. The Environmental Quality Commission adopted Table 33A on May 20, 2004 to become effective February 15, 2005. However, EPA has not yet (as of June 2005) approved the criteria for federal Clean Water Act purposes., Table 20 should be used for federal Clean Water Act purposes (except for Section 303(d) listing which should only use Table 20 until these criteria receive EPA approval).

EPA, 1997. *Ambient Water Quality Criteria Document for Tributyltin*, U.S. Environmental Protection Agency, 62 FR 42554, August 7, 1997.
-Freshwater Chronic Criteria.

EPA, 1998 *National Recommended Water Quality Criteria*. Federal Register 63 (Dec. 10): 68353-64.

EPA, 1999. *National Recommended Water Quality Criteria — Correction*. EPA 822-Z-99-001. Office of Water.

EPA, 2003. *National Primary Drinking Water Standards.* EPA 816-F-02-013. Office of Water. June 2003. Available on EPA's website at: http://www.epa.gov/safewater/mcl.html#mcls

EPA, 2004. *Region 9 PreliminaryRemediation Goals*, prepared by Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Team, San Francisco, California. Revision Date: 12/28/04

EPA, 2004. *National Recommended Water Quality Criteria*. United States Office of Water - Environmental Protection Office of Science and Technology 2004. Agency (4304T).

MacDonald DD, et. al., 1999. *A Compendium of Environmental Quality Benchmarks*. Prepared for Environment Canada by MacDonald Environmental Sciences Limited. GBEI/EC-99-001.

MacDonald DD, Ingersoll C.G., Berger T.A., 2000. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*. Environmental Contamination and Toxicity 39: 20-31.
- Probable Effects Concentrations (PECs)

NOAA, 1999. *Freshwater Sediment*, *Screening Quick Reference Tables (SQuiRTs)*. NOAA, Coastal Resource Coordination Branch, Hazmat Report 99-1.
- Threshold Effects Level (TEL) or lowest ARCs *H. azteca* TEL.
- Upper Effects Threshold (UELs).
- Upper Effects Threshold (UET).
- Probable Effects Levels (PELs).
- Apparent Effects Threshold (AET).

Smith, SL., MacDonald, DD, Keenleyside, KA, Ingersoll, CG, and Field, J. 1996. *A preliminary evaluation of sediment quality assessment values for freshwater ecosystems*. Journal of Great Lakes Research 22:624-638.
- Threshold Effects Concentration (TEC).

Suter, G. W., and C. L. Tsao, 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota*. Rev. ES/ER/TM-96/R2. Oak Ridge National Laboratory, TN.

WDOE, 1997. *Creation and Analysis of Freshwater Sediment Quality Values in Washington State*. Lowest Apparent Effects Threshold (LAET), Table 11, Washington Department of Ecology, Pub. No. 97-323a. July 1997.

USCOE, 1998. *Dredged Material Evaluation Framework, Lower Columbia River Management Area.* U.S. Army Corps of Engineers. April 1998. Draft.
- Screening Level (SL), Table 8-1.

8.3 Portland Harbor Investigations

Weston, 1998. *Portland Harbor Sediment Investigation Report, Multnomah County, Oregon*. Report No. 04000-019-036-AACE. Prepared for the U.S. Environmental Protection Agency and Oregon Department of Environmental Quality, Portland, OR. Roy F. Weston, Inc. Seattle, WA.

LWG, 2003. *Portland Harbor RI/FS – Upland Groundwater Data Review – River Mile 2-11 Lower Willamette River (Volumes 1 through 3).* Prepared by Groundwater Solutions, Inc. Prepared for The Lower Willamette Group (LWG). Dated June 2, 2003.

LWG, 2004a. *Portland Harbor RI/FS - Programmatic Work Plan(Volumes 1 through 3).* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., Kennedy/Jenks Consultants, Anchor Environmental L.L.C., and Groundwater Solutions, Inc. Prepared for The Lower Willamette Group (LWG). Dated April 23, 2004.

LWG, 2004b. *Portland Harbor RI/FS – Draft Conceptual Site Model Update (Volumes 1 through 3).* Prepared by Integral Consulting, Inc. and Groundwater Solutions, Inc. Prepared for The Lower Willamette Group (LWG). Dated September 17, 2004.

LWG, 2004c. *Portland Harbor RI/FS – Round 2 – Field Sampling Plan – Sediment Sampling and Benthic Toxicity Testing.* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., and Anchor Environmental L.L.C. Prepared for The Lower Willamette Group (LWG). Dated March 22, 2004.

City of Portland, 2000. *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area, (Eastshore)*. July 2000.

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Table 3-1 7/16/07 Revision

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[A]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]	
		Water [C]									**Soil/Stormwater Sediment**[D]	
		Human Health[#]						Ecological Receptors[#]			Toxicity	Bioaccumulation
		Fish Consumption				Drinking Water						
		EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[i]	MacDonald PECs and other SQVs [1]	DEQ 2007 Bioaccumulative Sediment SLVs [E]
Chemical		17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate							
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
NOTE: Numbers highlighted in yellow are values to be used for initial upland source control screening evaluations for water.											**NOTE: Numbers highlighted in orange are to be used for initial upland source control screening evaluations for soil and stormwater sediment.**	
Metals/Inorganics	CAS #	Metals in these columns are expressed as dissolved metal in the water column except where noted		Metals in these columns are expressed in terms of total recoverable metal in the water coulmn				Metals in this column are expressed as dissolved metal in the water column except where noted	Metals in this column are expressed in terms of total recoverable metal in the water coulmn			
Aluminum (pH 6.5 - 9.0)[13]	7429-90-5					**(50-200)[29]**	37,000	87				
Antimony	7440-36-0	640	64	640	64	**6**	15		1600 [16]	30	**64,000 [3]**	
Arsenic	7440-38-2	0.14	0.014	0.14	0.014	10	**0.045**	150		3.1[a]	33,000 [2]	**7000 [31]**
Arsenic III	22569-72-8								**190 [14]**			
Cadmium[15]	7440-43-9					5	18	**0.094**	0.38 [14]		4,980 [2]	**1000[31]**
Chromium, total	7440-47-3					**100**					**111,000 [2]**	
Chromium, hexavalent	18540-29-9						110	**11**	11 [14]			
Copper[15]	7440-50-8					1,300 = TT	1,400	**2.7**	3.6 [14]		**149,000 [2]**	
Lead[15]	7439-92-1					15 = TT	15	**0.54**	0.54 [14]		128,000 [2]	**17000 [31]**
Manganese	7439-96-5	100	10	100	10	**(50)[29]**	1700			120	**1,100,000 [6,9]**	
Mercury	7439-97-6			0.146	0.0146	2	11	**0.77**	0.012	1.3[b]	1,060 [2]	**70 [31]**
Methyl Mercury	22967-92-6	300 µg/kg [20]	30 µg/kg [20]	300 µg/kg [20]	30 µg/kg [20]		3.7			**0.0028**		
Nickel[15]	7440-02-0	4,600	460	4,600	460		730	**16**	49 [14]		**48,600 [2]**	
Selenium	7782-49-2	4,200	420	4,200	420	50	180	**5 [19]**	35 [14]		5,000 [4]	**2000 [31]**
Silver [15]	7440-22-4					(100)[29]	180		**0.12 [14]**	0.36	**5,000 [5, 4]**	
Zinc[15]	7440-66-6	26,000	2,600	26,000	2,600	(5,000)[29]	11,000	**36**	33		**459,000 [2]**	
Perchlorate	14797-73-0						**<24.5**					
Cyanide[18]	57-12-5	140	14	140	14	200	730	**5.2**	5.2			

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (A)

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER — Water (C) — Human Health # — Fish Consumption — EPA's 2004 NRWQC (organism only) — 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate — 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) — 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate — 175 g/day consumption rate	Drinking Water — MCL	Tap Water PRGs	GROUNDWATER / SURFACE WATER / STORMWATER — Ecological Receptors # — EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV) (J)	UPLAND SOIL / STORMWATER SEDIMENT (D) — Soil/Stormwater Sediment (D) — Toxicity — MacDonald PECs and other SQVs (1)	Bioaccumulation — DEQ 2007 Bioaccumulative Sediment SLVs (E)
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
Butyltins 12												
Monobutyltin	78763-54-9											
Dibutyltin	1002-53-5											
Tributyltin	56573-85-4						11	**0.072**				**2.3 (32)**
Tetrabutyltin	1461-25-2											
PCBs Aroclors												
Aroclor 1016	12674-11-2						**0.96**				**530 (9)**	
Aroclor 1221	11104-28-2						**0.034**			0.28		
Aroclor 1232	11141-16-5						**0.034**			0.58		
Aroclor 1242							**0.034**			0.053		
Aroclor 1248	12672-29-6						**0.034**			0.081	**1,500 (9)**	
Aroclor 1254	11097-69-1						0.034			**0.033**	**300 (9)**	
Aroclor 1260	11096-82-5						**0.034**			94	**200 (9)**	
Aroclor 1262	37324-23-5											
Aroclor 1268	11100-14-4											
Total PCBs		**0.000064**	0.0000064	0.000064	0.0000064	0.5	0.034	0.014	0.014	0.14	676 (2)	**0.39 (33)**
PCB Congeners												
All 209 PCB congener target analytes												
3,3',4,4'-TCB	32598-13-3											**0.052 (33)**
3,4,4',5-TCB												**0.017 (33)**
2,3,3',4,4'-PeCB	32598-14-4											**0.17 (33)**
2,3,4,4',5-PeCB												**0.17 (33)**
2,3',4,4',5-PeCB	31508-00-6											**0.12 (33)**
2',3,4,4',5-PeCB												**0.21 (33)**
3,3',4,4',5-PeCB												**0.00005 (33)**
2,3,3',4,4',5'-HxCB												**0.21 (33)**
2,3,3',4,4',5-HxCB												**0.21 (33)**
2,3',4,4',5,5'-HxCB												**0.21 (33)**
3,3',4,4',5,5'-HxCB	32774-16-6											**0.00021 (33)**
2,3,3',4,4',5,5'-HpCB												**1.2 (33)**
Chlorinated Herbicides												
Dalapon	75-99-0					**200**	1,100					

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[A]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [D]	
		Water [C]									Soil/Stormwater Sediment[D]	
		Human Health#						Ecological Receptors#			Toxicity	Bioaccumulation
		Fish Consumption				Drinking Water						
		EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[j]	MacDonald PECs and other SQVs [1]	DEQ 2007 Bioaccumulative Sediment SLVs [E]
		17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate							
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
Dicamba	1918-00-9						**1,100**					
MCPA	94-74-6						**18**					
Dichlorprop	120-36-5						**370**					
2,4-D	94-75-7					**70**	370					
2,4,5-TP (Silvex)	93-72-1					**50**	370					
2,4,5-T	93-76-5						**370**					
2,4-DB	94-82-6						**290**					
Dinoseb	88-85-7					**7**	37					
MCPP	93-65-2						**37**					
Organochlorine Pesticides												
α - BHC	319-84-6	**0.0049**	0.00049	0.0049	0.00049		0.011			2.2[c]		
β - BHC	319-85-7	**0.017**	0.0017	0.017	0.0017		0.037					
γ - BHC (Lindane)	58-89-9	1.8	0.18	1.8	0.18		**0.052**		0.08		**4.99** [2]	
δ - BHC	319-86-8						**0.037**					
Heptachlor	76-44-8	**0.000079**	0.0000079	0.000079	0.0000079	0.4	0.015	0.0038	0.0038	0.0069	**10** [6]	
Heptachlor epoxide	102-45-73	**0.000039**	0.0000039	0.000039	0.0000039	0.2	0.0074	0.0038	0.0038		**16** [2]	
Aldrin	309-00-2	**0.00005**	0.000005	0.00005	0.000005		0.004				**40** [6]	
Chlordane	57-74-9	**0.00081**	0.000081	0.00081	0.000081	2	0.19	0.0043	0.0043		17.6 [2]	**0.37** [33]
Endosulfan alpha-	959-98-8	89	8.9	89	8.9		220	0.056	0.056	**0.051**		
Endosulfan beta-	33213-65-9	89	8.9	89	8.9		220	0.056	0.056	**0.051**		
Endosulfan sulfate	1031-07-8	**89**	8.9	89	8.9							
DDE [34]	72-55-9	**0.00022**	0.000022	0.00022	0.000022		0.2				31.3[2]	**0.33**
DDD [34]	72-54-8	**0.00031**	0.000031	0.00031	0.000031		0.28			0.011[d]	28[2]	**0.33**
DDT [34]	50-29-3	**0.00022**	0.000022	0.00022	0.000022		0.2	0.001	0.001	0.013[e]	62.9[2]	**0.33**
DDT - total [35]	50-29-3						**0.2**					**0.33** [33]
Dieldrin	60-57-1	**0.000054**	0.0000054	0.000054	0.0000054		0.0042	0.056	0.0019[14]		61.8 [2]	**0.0081** [33]
Endrin	72-20-8	0.06	0.006	0.06	0.006	2	11	**0.036**	0.0023 [14]	0.061	**207** [2]	
Endrin aldehyde	7421-93-4	0.3	0.03	0.3	0.03							
Endrin ketone	53494-70-5											
Methoxychlor	72-43-5					40	180	**0.03**	0.03	0.019		
Toxaphene	8001-35-2	0.00028	0.000028	0.00028	0.000028	3	0.061	**0.0002**	0.0002			
oxy chlordane							**0.19**					
cis - nonachlor	5103-73-1						**0.19**					
trans - nonachlor	39765-80-5						**0.19**					
Volatile Organic Compounds												

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[(A)]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER — Water (C) — Human Health# — Fish Consumption — EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	Drinking Water — MCL	Tap Water PRGs	GROUNDWATER / SURFACE WATER / STORMWATER — Ecological Receptors# — EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[(J)]	UPLAND SOIL / STORMWATER SEDIMENT (D) — Soil/Stormwater Sediment[(D)] — Toxicity — MacDonald PECs and other SQVs [(I)]	Bioaccumulation — DEQ 2007 Bioaccumulative Sediment SLVs [(E)]
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
1,1,1,2- Tetrachloroethane	630-20-6						**2.5**					
1,1,1- Trichloroethane (TCA)	71-55-6					200	840			**11**		
1,1,2,2- Tetrachloroethane	79-34-5	4	0.4	4	0.4		**0.33**		2,400 [(16)]	**610**		
1,1,2- Trichloroethane	79-00-5	16	1.6	16	1.6	5	**1.2**		9,400 [(16)]	**1,200**		
1,1- Dichloroethane	75-34-3						1200			**47**		
1,2,3- Trichloropropane	96-18-4						**0.0095**					
1,2- Dichloroethane (EDC)	107-06-2	37	3.7	37	3.7	5	**0.73**		20,000 [(16)]	910		
cis-1,2-Dichloroethlyene	156-59-2					70	**61**					
1,2- Dichloropropane	78-87-5	15	1.5	15	1.5	5	**0.97**					
1,2- Dibromoethane (EDB)	106-93-4						**0.033**					
2- Butanone (MEK)	78-93-3						**7,100**			14,000		
2- Chloroethyl Vinyl Ether	110-75-8											
2- Hexanone	591-78-6									**99**		
4- Methyl-2-Pentanone (MIBK)	108-10-1						2000			**170**		
Acetone	67-64-1						5,500			**1,500**		
Acrolein	107-02-8	290	29	290	29		**0.042**		21 [(16)]			
Acrylonitrile	107-13-1	0.25	0.025	0.25	0.025		**0.12**		2,600 [(16)]			
Bromochloromethane	74-97-5											
Bromodichloromethane	75-27-4						**1.1**					
Bromoform	75-25-2	140	14	140	14		**8.5**					
Bromomethane	74-83-9						**8.7**					
Carbon Disulfide	75-15-0						1,000			**0.92**		
Carbon Tetrachloride	56-23-5	1.6	0.16	1.6	0.16	5	**0.51**			9.8		
Chlorobenzene	108-90-7	1600	160	1,600	160	100	91		**50** [(16)]	64		
Chlorodibromomethane	124-48-1	13	1.3	13	1.3		**0.79**					
Chloroethane	75-00-3						**23**					
Chloroform	67-66-3	470	47	470	47		**0.17**		1,240 [(16)]	28		
Chloromethane	74-87-3						**2.1**					
cis-1,2-dichloroethylene	156-59-2									**590**		
cis-1,3-Dichloropropene	10061-01-5									**0.055**		
Dibromomethane	74-95-3						**61**					
Dichlorodifluoromethane	75-71-8						**390**					
Iodomethane (Methyl Iodide)	74-88-4											
Isopropylbenzene	98-82-8						**660**					
Methylene chloride	75-09-2	590	59	590	59		**8.9**			2,200		
Styrene	100-42-5					**100**	1,600					
trans-1,4-Dichloro-2-butene	110-57-6						**7100**					
Trichlorofluoromethane	75-69-4						**1,300**					
Vinyl Acetate	108-05-4						410			**16**		
Benzene	71-43-2	51	5.1	51	5.1	5	**1.2**			130		

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[(A)]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER — Water [(C)] — Human Health[#] — Fish Consumption — EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	Drinking Water — MCL	Tap Water PRGs	GROUNDWATER / SURFACE WATER / STORMWATER — Ecological Receptors[#] — EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[(i)]	UPLAND SOIL / STORMWATER SEDIMENT [(D)] — Soil/Stormwater Sediment[(D)] — Toxicity — MacDonald PECs and other SQVs [(1)]	Bioaccumulation — DEQ 2007 Bioaccumulative Sediment SLVs [(E)]
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
EthylBenzene	100-41-4	2,100	210	2,100	210	700	1,300			**7.3**		
m,p-Xylene										**1.8[(f)]**		
o-Xylene	95-47-6						1400			**13[(g)]**		
Xylenes (total)	1330-20-7					10,000	**200**					
Methyltert-butyl ether	1634-04-4						**37**					
Tetrachloroethene (PCE)	127-18-4	3.3	0.33	3.3	0.33	5	**0.12**		840 [(16)]	98	**500[(7)]**	
Toluene	108-88-3	15,000	1,500	15,000	1,500	1,000	2300			**9.8**		
trans-1,2-Dichloroethene	156-60-5	10,000	1,000	10,000	1,000	100	**110**			590		
trans-1,3-Dichloropropene	10061-02-6						0.4			**0.055**		
Trichloroethene (TCE)	79-01-6	30	3	30	3	5	**0.17**		21,900 [(16)]	47	**2,100[(7)]**	
Vinyl Chloride	75-01-4	2.4	0.24	2.4	0.24	2	**0.015**					
Semivolatile Organic Compounds												
Halogenated Compounds												
1,2-Dichlorobenzene	95-50-1	1,300	130	1,300	130	600	**49**		763 [(16)]	14	**1,700 [(7)]**	
1,3-Dichlorobenzene	541-73-1	960	96	960	96		**14**		763 [(16)]	71	**300 [(7)]**	
1,4-Dichlorobenzene	106-46-7	190	19	190	19	75	**2.8**		763 [(16)]	15	**300 [(7)]**	
1,2,4-Trichlorobenzene	120-82-1	70	7	70	7	70	**8.2**			110	**9,200 [(7)]**	
Hexachlorobenzene	118-74-1	**0.00029**	0.000029	0.00029	0.000029	1	0.042				100 [(6)]	**19 [(33)]**
2-Chloronaphthalene	91-58-7	1,600	160	1,600	160		**490**					
Hexachloroethane	67-72-1	**3.3**	0.33	3.3	0.33		4.8		540 [(16)]	12		
Hexachlorobutadiene	87-68-3	18	1.8	18	1.8		**0.86**		9.3 [(16)]		**600 [(8)]**	
Hexachlorocyclopentadiene	77-47-4	1,100	110	1,100	110	50	220		**5.2 [(16)]**		**400 [(8)]**	
2,2'-oxybis(1-chloropropane)	108-60-1						**0.95**					
Bis-(2-chloroethoxy) methane	111-91-1											
Bis-(2-chloroethyl) ether	111-44-4	0.53	0.053	0.53	0.053		**0.06**					
4-Chlorophenyl-phenyl ether	7005-72-3						**0.06**					
4-bromophenyl-phenyl ether	101-55-3											
3,3'-Dichlorobenzidine	91-94-1	**0.028**	0.0028	0.028	0.0028		0.15		763 [(16)]			
4-Chloroaniline	106-47-8						**150**					
Organonitrogen Compounds												
Nitrobenzene	98-95-3	690	69	690	69		**3.4**					
Aniline	62-53-3						**12**					
2-Nitroaniline	88-74-4						**110.0**					
3-Nitroaniline	99-09-2						**3.2**					
4-Nitroanilinc	100-01-6						**3.2**					

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[(A)]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER — Water [(C)] — Human Health[#] — Fish Consumption — EPA's 2004 NRWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	DEQ's 2004 AWQC (organism only) 17.5 g/day consumption rate	Portland Harbor specific fish consumption rate 175 g/day consumption rate	Drinking Water — MCL	Tap Water PRGs	GROUNDWATER / SURFACE WATER / STORMWATER — Ecological Receptors[#] — EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[(J)]	UPLAND SOIL / STORMWATER SEDIMENT [(D)] — Soil/Stormwater Sediment[(D)] — Toxicity — MacDonald PECs and other SQVs [(1)]	Bioaccumulation — DEQ 2007 Bioaccumulative Sediment SLVs [(E)]
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
N-Nitrosodimethylamine	62-75-9	3	0.3	3	0.3		**0.00042**					
N-Nitroso-di-n-propylamine	621-64-7	0.51	0.051	0.51	0.051		**0.0096**					
N-Nitrosodiphenylamine	86-30-6	**6**	0.6	6	0.6		14			210		
2,4-Dinitrotoluene	121-14-2	**3.4**	0.34	3.4	0.34		73					
2,6-Dinitrotoluene	606-20-2						**37**					
Carbazole	86-74-8						**3.4**				**1,600** [(5)]	
Oxygen-Containing Compounds												
Benzoic Acid	65-85-0						150,000			**42**		
Benzyl Alcohol	100-51-6						11,000			**8.6**		
Dibenzofuran	132-64-9						12			**3.7**		
Isophorone	78-59-1	960	96	960	96		**71**					
Phenols and Substituted Phenols												
Phenol	108-95-2	1,700,000	170,000	1,700,000	170,000		11,000		**2,560** [(16)]		**50** [(5, 6)]	
2-Methylphenol (o-Cresol)	95-48-7						1,800			**13**		
4-Methylphenol (p-Cresol)	106-44-5						**180**					
2,4-Dimethylphenol	105-67-9	850	85	850	85		**730**					
2-Chlorophenol	95-57-8	150	15	150	15		**30**		2,000 [(16)]			
2,4-Dichlorophenol	120-83-2	290	29	290	29		**110**		365 [(16)]			
2,4,5-Trichlorophenol	95-95-4	**3,600** [(24)]	360 [(24)]	3,600	360		3,700					
2,4,6-trichlorophenol	88-06-2	**2.4**	0.24	2.4	0.24		6.1		970 [(16)]			
2,3,4,6-Tetrachlorophenol	58-90-2						**1,100**					
Pentachlorophenol	87-86-5	3	0.3	3	0.3	1	**0.56**	15 [(22)]	13 [(14,23)]		1,000 [(8)]	**250** [(33)]
4-Chloro-3-methylphenol	59-50-7											
2-Nitrophenol	88-75-5						1100		**150** [(16)]			
4-Nitrophenol	100-02-7						290		**150** [(16)]	300		
2,4-Dinitrophenol	51-28-5	5,300	530	5,300	530		**73**		150 [(16)]			
Methyl-4,6-Dinitrophenol 2-	534-52-1	280	28	280	28				**150** [(16)]			
Phthalate Esters												
Dimethylphthalate	131-11-3	1,100,000	110,000	1,100,000	110,000		370,000		**3** [(16)]			
Diethylphthalate	84-66-2	44,000	4,400	44,000	4,400		29,000		**3** [(16)]	210	**600** [(7)]	
Di-n-butylphthalate	84-74-2	4,500	450	4,500	450		3,700		**3** [(16)]		100 [(6)]	**60**
Butylbenzylphthalate	85-68-7	1900	190	1900	190		7,300		**3** [(16)]	19		
Di-n-octylphthalate	117-84-0						1,500		**3** [(16)]			
bis(2-Ethylhexyl)phthalate	117-81-7	**2.2**	0.22	2.2	0.22	6	4.8		3 [(16)]		800 [(5, 6)]	330

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water(A)

		GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT (D)	
		Water (C)									Soil/Stormwater Sediment(D)	
		Human Health#						Ecological Receptors#			Toxicity	Bioaccumulation
		Fish Consumption				Drinking Water						
		EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)(i)	MacDonald PECs and other SQVs (1)	DEQ 2007 Bioaccumulative Sediment SLVs (E)
Chemical		17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate							
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
Polycyclic Aromatic Hydrocarbons												
Naphthalene	91-20-3					**0.2 (26)**	6.2		620 (16)	12	**561 (2)**	
2-Methylnaphthalene	91-57-6					**0.2 (26)**				2.1 (h)	**200 (11)**	
Acenaphthylene	208-96-8					**0.2 (26)**					**200 (6)**	
Acenaphthene	83-32-9	990	99	990	99	**0.2 (26)**	370		520 (16)		**300 (6)**	
Fluorene	86-73-7	5,300	530	5,300	530	**0.2 (26)**	240			3.9	**536 (2)**	
Phenanthrene	85-01-8					**0.2 (26)**					**1,170 (2)**	
Anthracene	120-12-7	40,000	4,000	40,000	4,000	**0.2 (26)**	1,800			0.73	**845 (2)**	
Fluoranthene	206-44-0	140	14	140	14	**0.2 (26)**	1,500				**2,230 (2)**	37000 (32)
Pyrene	129-00-0	4,000	400	4,000	400	**0.2 (26)**	180				**1,520 (2)**	1900 (32)
Benzo(a)anthracene	56-55-3	**0.018**	0.0018	0.018	0.0018	0.2 (26)	0.092			0.027	**1,050 (2)**	
Chrysene	218-01-9	**0.018**	0.0018	0.018	0.0018	0.2 (26)	9.2				**1,290 (2)**	
Benzo(b)fluoranthene	205-99-2	**0.018**	0.0018	0.018	0.0018	0.2 (26)	0.092					
Benzo(k)fluoranthene	207-08-9	**0.018**	0.0018	0.018	0.0018	0.2 (26)	0.92				**13,000 (6)**	
Benzo(a)pyrene	50-32-8	**0.018**	0.0018	0.018	0.0018	0.2	0.0092			0.014	**1,450 (2)**	
Indeno(1,2,3-cd)pyrene	193-39-5	**0.018**	0.0018	0.018	0.0018	0.2 (26)	0.092				**100 (10)**	
Dibenz(a,h)anthracene	53-70-3	**0.018**	0.0018	0.018	0.0018	0.2 (26)	0.0092				**1,300 (9)**	
Benzo(g,h,i)perylene	191-24-2					**0.2 (26)**					**300 (16)**	
Chlorinated Dioxins and Furans												
2,3,7,8,-TCDD (Toxicity Equivalence Quotient	1746-01-6	**5.1E-09**	5.1E-10	5.1E-09	5.1E-10	0.00003	4.5E-07					
2,3,7,8,-TCDD	1746-01-6	**5.1E-09**	5.1E-10	5.1E-09	5.1E-10		4.5E-07		0.00038 (16)		0.009 (6)	**0.0000091 (33)**
2,3,7,8,-TCDF												**0.00077 (33)**
1,2,3,7,8,-PeCDD												**0.0026 (33)**
1,2,3,7,8,-PeCDF												**0.0026 (33)**
2,3,4,7,8,-PeCDF												**0.00003 (33)**
2,3,4,7,8,-PeCDF												
1,2,3,6,7,8,-HxCDD												
1,2,3,7,8,9,-HxCDD												
1,2,3,4,7,8,-HxCDF												**0.0027 (33)**
1,2,3,6,7,8,-HxCDF												**0.0027 (33)**
1,2,3,7,8,9,-HxCDF												**0.0027 (33)**

Table 3-1 Screening Level Values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water[(A)]

Chemical		GROUNDWATER / SURFACE WATER / STORMWATER						GROUNDWATER / SURFACE WATER / STORMWATER			UPLAND SOIL / STORMWATER SEDIMENT [(D)]	
		Water [(C)]									**Soil/Stormwater Sediment**[(D)]	
		Human Health[#]						Ecological Receptors[#]			Toxicity	Bioaccumulation
		Fish Consumption				Drinking Water						
		EPA's 2004 NRWQC (organism only)	Portland Harbor specific fish consumption rate	DEQ's 2004 AWQC (organism only)	Portland Harbor specific fish consumption rate	MCL	Tap Water PRGs	EPA's 2004 NRWQC (chronic)	DEQ's 2004 AWQC (chronic)	Oak Ridge National Laboratory's (Tier II SCV)[(J)]	MacDonald PECs and other SQVs [(1)]	DEQ 2007 Bioaccumulative Sediment SLVs [(E)]
Chemical		17.5 g/day consumption rate	175 g/day consumption rate	17.5 g/day consumption rate	175 g/day consumption rate							
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/kg	µg/kg
2,3,4,6,7,8,-HxCDF												**0.0027** [(33)]
1,2,3,4,6,7,8,-HpCDD												**0.69** [(33)]
1,2,3,4,6,7,8,-HpCDF												**0.69** [(33)]
1,2,3,4,7,8,9,-HpCDF												**0.69** [(33)]
OCDD	3268-87-9											**23** [(33)]
OCDF	39001-02-0											**23** [(33)]
Total tetrachlorinated dioxins												
Total pentachlorinated dioxins												
Total hexachlorinated dioxins												
Total heptachlorinated dioxins												
Total tetrachlorinated furans												
Total pentachlorinated furans												
Total hexachlorinated furans												
Total heptachlorinated furans												

Note: This table may be revised when new data becomes available. Check http://www.deq.state.or.us/nwr/Portland Harbor/jscs for updates. (!)

Notes:

[A] Stormwater values in this table are intended for screening non-permitted discharges.

[C] EPA, under CERCLA authority, has identified the Sage Drinking Water Act's MCLs and AWQCs (federal and state, once approved) as potentialARARs under CERCLA. The final determination of whether MCLs or AWQC are ARARs will be made in the EPA Portland Harbor Record of Decision (ROD). Decisions to implement source control, prior to the EPA Portland Harbor ROD, due to an exceedance of an SLV in upland groundwater or stormwater will be prioritized and evaluated on a case-by-case basis.

[D] Stormwater sediment is defined as either catch basin sediment, conveyance line sediment, or stormwater particulates

[E] All values are from DEQ Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment, January 31, 2007.

[ ] a blank cell indicates an SLV was not available at the time of the last update. DEQ or EPA may develop additional SLVs as determined necessary, on a case-by-case basis.

[1] The values were chosen by first referring to the PEC's in the paper listed in footnote 2. If the analyte was not found, we then used the other literature listed in footnotes 3 through 11 to find the value.

[2] These values were taken MacDonald DD, Ingersoll C.G., Berger T.A. (2000) Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Environmental Contamination and Toxicity 39: 20-31.

[3] Sediment quality value (Hyalella), Washington State, quoted in MacDonald et al. (1999); Appendix 3-1.

[4] Quoted in MacDonald et al. (1999); Appendix 3-1

[5] Lowest Apparent Effects Threshold (LAET), Table 11, WDOE (1997)

[6] Upper Effects Threshold (UET), Freshwater Sediment (NOAA, 1999)

[7] USEPA sediment quality advisory level, quoted in MacDonald et al. (1999); Appendix 3-1

[8] New York State acute criterion, quoted in MacDonald et al. (1999); Appendix 3-1

[9] Severe effect level, British Columbia, quoted in MacDonald et al. (1999); Appendix 3-1

[10] 5x conversion from measured "LOW" to estimated "HIGH", NOAEL to chronic LOAEL per USEPA (1997b)

[11] PEL, British Columbia, quoted in MacDonald et al. (1999); Appendix 3-1

[12] Based on Notice of Availability of Final Aquatic Life Criteria Document for Tributyltin (69 Fed. Reg. 2, 342). USGS web site (http://nwis.waterdata.usgs.gov/or/nwis/qwdata/?site_no=14211720&agency_cd=USGS)

[13] These values for aluminum are expressed in terms of "total recoverable" concentration of metal in the water column. The criterion applies at pH<6.6 and hardness<12 mg/L (as $CaCO_3$)

[14] These values were taken from OAR 340-41 Table 20 because they will remain the enforceable values for these particular analytes

[15] This is a hardness dependent metal. All values were calculated based on 25 mg/l of $CaCO_3$.

[16] Values were taken from Table 33c (OAR 340-41), which are Water Quality Guidance Values, not criteria, that can be used in the application of Oregon's Narrative Toxics Criteria to waters of the state in order to protect aquatic life.

[18] Cyanide value is based on a free cyanide value per DEQ OAR 340-41 Table 33, and EPA values are based on total Cyanide

[19] This metal is listed as the total recoverable metal in the water column

[20] This fish tissue residue criterion for methylmercury is based on a total fish consumption rate of 0.0175 kg/day

[22] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.134). The value displayed in the table corresponds to a pH of 7.8

[23] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: Chronic = exp(1.005(ph)-5.29). The value displayed in the table corresponds to a pH of 7.8

[24] Listed as a secondary pollutant by EPA

[#] Table 20 from OAR 340-40 was superceded by Tables 33A, 33B, and 33C. As noted above, 33A and 33C were adopted the Oregon Environmental Commission and were effective in February 2005. Implementation of Table 33B (i.e., metals) is pending EPA approval; Table 20 will be used for the compounds listed in Table 33B, pending approval and implementation.

Tier II SCV

(a) = value for Arsenic V

(b) = see notation for ORNL's Mercury value

(c) = SCV for BHC (other)

(d) = SCV for p,p' DDD

(e) = SCV for p,p' DDT

(f) = SCV for m-Xylene

General

AWQC = ambient water quality criteria

MRL = minimum reporting limit

NRWQC = National Recommended Water Quality Criteria

ORNL = Oak Ridge National Laboratory

PRG = preliminary remediation goals

Note: This table may be revised when new data becomes available. Check http://deq.state.or.us/nwr/Portland Harbor/jscs for updates (!)

(g) = SCV for Xylene mixture

(h) = SCV for 1-Methylnaphthalene

(!) Screening level values (SLVs) presented in this table may be revised or augmented as data become available from the Portland Harbor RI/FS or in the event the standards, criteria, guidelines or toxicological data are updated. Prior to using this Table, DEQ's website should be checked for updates to this table at http://www.deq.state.or.us/nwr/PortlandHarbor/jscs.

(j) = Tier II SCV values were taken from Suter II, G.W. and Tsao, C.L., 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ORNL publication ES/ER/TM-96/R2

MCL

[26] MCL is based on benzo(a)pyrene

[29] National Secondary Drinking Water Standards

[31] Presumed background, per Table A-1, DEQ Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment, January, 31, 2007.

[32] Freshwater fish, per Table A-1, DEQ Guidance for Bioaccumulative Chemcials of Concern in Sediment, January 31, 2007.

[33] Human Health General Population, per Table A-1, DEQ Guidance for Bioaccumulative Chemicals of Concern in Sediment, January 31, 2007.

[34] This value represents the sum of the 2,4' and 4,4' isomers.

[35] This value represents the sum of DDE + DDD + DDT.

TT = see footnote 7 on EPA NPD Drinking Water Standards

Appendix A

Regulatory Framework, Standards, and Criteria

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Appendix A Regulatory Framework, Standards, and Criteria

This section describes an overview the regulatory framework that will be used to identify and control sources of contamination to Portland Harbor. It focuses on the State of Oregon's environmental cleanup authority and the regulatory framework for controlling point and non-point discharges to Portland Harbor. This appendix is provided for informational purposes only and is not intended to be comprehensive.

A.1 Regulatory Framework for Oregon's Environmental Site Cleanups

Upland cleanup sites are identified, investigated, and cleaned up by the DEQ under Oregon Revised Statute (ORS) 465 and Oregon Administrative Rules (OAR) Chapter 340 Division 122 (Hazardous Substance Remedial Action Rules). The majority of upland investigations and cleanups are carried out under Voluntary Cleanup Letter Agreements, Voluntary Cleanup Agreements, Consent Orders, and Unilateral Orders funded by responsible parties. When the responsible party is unknown, unwilling, or unable to undertake the required removal or remedial action activities, DEQ may use funds from its Orphan Site Account to perform the work itself. The DEQ plans to use its removal authority to implement source control measures for most Portland Harbor upland cleanup sites.

Oregon's environmental cleanup law is generally modeled after the federal cleanup requirements specified in the National Contingency Plan (NCP). In both cases, a remedial investigation is completed to characterize the site, a risk assessment is performed to determine the risk to human health and the environment and establish risk-based cleanup goals, a feasibility study is performed to evaluate remedial action alternatives that ensure protection of human health and the environment, and a Record of Decision is issued describing the selected remedial action. There are some differences between the two cleanup programs, as described in the following sections.

A.1.1 Protection of Human Health and the Environment

Oregon's environmental cleanup law requires all remedial actions to be protective of human health and the environment. DEQ remedial actions must meet the following acceptable risk levels:

- An excess lifetime cancer risk (ELCR) 10^{-6} for human exposure to individual carcinogens;
- An ELCR of 10^{-5} for human exposure to multiple carcinogens;
- A Hazard Index of 1 for human exposure to non-carcinogens;
- A Toxicity Index of 1 for threatened or endangered (T&E) species; and
- Less than a 10% chance that more than 20% of the population of a non-T&E ecological receptor will be exposed to unacceptable levels.

These acceptable risk levels are based on exposures resulting from current and reasonably likely future land and water uses.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also know as "Superfund," EPA requires all remedies to meet two threshold criteria: (1) overall protection of human health and the environment and (2) compliance with applicable and relevant or appropriate requirements[1] (ARARs). Factors considered in determining overall protection include achieving a protective risk range of 10^{-4} to 10^{-6} for known or suspected carcinogens, a Hazard Index of 1 for non-carcinogens, and no significant adverse impact on ecological receptors. Potential ARARs may include the Safe Drinking Water Act maximum contaminant levels (MCLs), water quality criteria established under the Clean Water Act, and state of Oregon cleanup criteria specified in OAR 340-122-115. ARARs may be waived by EPA in some cases.

A.1.2 Remedy Selection Balancing Factors

Under Oregon's environmental cleanup law, remedial actions are selected on the basis of effectiveness, long-term reliability, implementability, implementation (short-term) risk, and reasonableness of cost. Following identification of a proposed remedy, the law requires a minimum 30-day period for public notice and comment.

The balancing factors specified in the NCP are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. In addition, EPA applies two important modifying criteria: community and state acceptance.

A.1.3 Hot Spots of Contamination and Principal Threats

Oregon's environmental cleanup law requires that hot spots of contamination be treated or excavated and disposed of in a secure off-site location whenever feasible. Hot spot analyses are typically performed following a site-specific risk assessment in the feasibility study as a means of identifying if the type of remedial action is appropriate. The definition of a hot spot depends on the medium being treated:

- For groundwater or surface water, hot spots of contamination are defined as hazardous substances having a significant adverse effect on beneficial uses of water or waters to which the hazardous substances would be reasonably likely to migrate and for which treatment is reasonably likely to restore or protect such beneficial uses within a reasonable time, as determined in the feasibility study.
- For media other than water, hot spots are generally defined as hazardous substances that exceed hot spot concentrations or are not reliably containable as determined in the feasibility study. Hot spot concentrations are generally 100 times the acceptable

[1] Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires that on-site remedial actions attain or waive Federal environmental ARARs, or more stringent State environmental ARARs, upon completion of the remedial action. The 1990 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) also requires compliance with ARARs during remedial actions and during removal actions to the extent practicable. ARARs are identified on a site-by-site basis for all on-site response actions where CERCLA authority is the basis for cleanup (see EPA website http://www.epa.gov/superfund/action/guidance/remedy/arars.htm for further information).

risk level for human exposure to each individual carcinogen and 10 times the acceptable risk level for human exposure to each individual non-carcinogen and for ecological receptors.

Principal threats, as defined in the NCP, are similar to hot spots of contamination and must be treated wherever practicable. Principal threats are generally defined as areas contaminated with high concentrations of toxic compounds, liquids and other highly mobile materials or contaminated media that pose significant risk of exposure, or media containing contaminants several orders of magnitude above health-based levels.

A.1.4 DEQ Removal Authority

Under OAR 340-122-0070, the DEQ has broad authority to use removal actions to expedite cleanup activities when necessary. Removals may be performed as necessary to "prevent, minimize, or mitigate damage to the public health, safety and welfare, and the environment that might result from the release or threat of release of hazardous substances." Removals may be undertaken at any time from the discovery of a release or threat of a release through the completion of a remedial action. Removal actions are typically performed to address emergency situations or to perform interim cleanup actions that are not expected to be the final action at a site. Removal actions do not require a public notice and comment period. However, public notice is typically provided and, in some cases, an opportunity for public comment is provided for removal actions.

Although the DEQ does not generally distinguish between time-critical and non-time-critical removal actions, it does recognize that emergency (*i.e.*, time-critical) removal actions may be required to address some contaminant releases to Portland Harbor. Time-critical removal actions are those actions that are required to address visible exceedances of narrative water quality criteria or other indications of imminent threat. Time-critical removal actions that may be applicable to Portland Harbor include the installation of sorbent booms or barrier walls to address product seeps to the Willamette River, the posting of warning signs, cleanup actions associated with spills and other direct discharges to the river, and bank stabilization efforts. Although not required by law, public notification of the time-critical removal action should be provided whenever possible.

For non-time-critical removal actions, the evaluation and selection of source control measures should be based on a focused feasibility study (*e.g.*, similar to the EPA EE/CA process) performed under DEQ's cleanup rules. Under this approach, a limited number of alternatives, including any presumptive remedies, are selected for detailed analysis. Only the most qualified technologies that apply to the media or source of contamination should be discussed. Evaluation of three alternatives is usually sufficient. (See Section 4 of the JSCS for more information).

A.2 Regulatory Framework for Point Source Discharges

Point source discharges are one of the identified contaminant migration pathways to the Willamette River and are regulated under the Clean Water Act through NPDES permits. Over 250 outfalls and about 100 facilities have NPDES permits have been identified within or near Portland Harbor. The Portland Harbor Programmatic Work Plan (LWG, 2004) lists the upland sites within Portland Harbor that have NPDES permits for the discharge of storm water to the Willamette River. A number of shoreline and upland sites do not have discharge permits because the activities described for their operations do not match the specific federal Standard Industrial Classification (SIC) codes that require a permit. Furthermore, since NPDES permits require monitoring of paved areas associated with industrial activities, but not general parking lot areas, contaminant transfer from these areas is not covered, even at permitted sites.

Permitted point source discharges within Portland Harbor include storm water discharges, industrial discharges, treated groundwater discharges, non-contact cooling water and boiler blow-down water. General permits have also been issued for construction activities within Portland Harbor. In most cases, construction activities are not expected to result in the discharge of hazardous substances to Portland Harbor. Some industries discharge their treated effluent to the City of Portland's Columbia Boulevard Treatment Plant, which discharges to the Columbia River upstream from the mouth of the Willamette River.

A.2.1 Individual NPDES Permits

There are 10 individual NPDES permits within or near Portland Harbor. These include:

- Ash Grove Cement Company;
- ATOFINA Chemicals;
- Aventis CropScience (a.k.a. Rhone Poulenc);
- Cascade General (a.k.a. Portland Shipyard);
- Kinder Morgan;
- Koppers Industries;
- Oregon Steel Mills;
- Vopack USA; and
- Siltronic Corporation.

The discharges allowed under these permits are a mix of production effluent, storm water discharges, and treated groundwater discharges.

A.2.2 General Industrial Storm Water Permits

In November 1990, EPA adopted regulations requiring NPDES permits for storm water discharges from certain industrial sites. Permits are required for specific industry classifications as established by EPA or if storm water leaves a site through a "point source" and reaches surface waters either directly or through storm drainage. A point source discharge refers to a natural or human-made conveyance of water through pipes, culverts, ditches, catch basins, or any other type of channel. Permits are also required for construction activities that disturb one or more acres.

Regulated industries are generally identified by a standard industrial code (SIC). Under the federal "no exposure" conditional exclusion, any facility covered by the storm water rules can receive an exemption from permitting requirements if they can certify that no industrial equipment or materials are exposed to storm water. To get an exclusion, a facility must submit a certification form to DEQ, which will then conduct or have the City of Portland conduct selected compliance visits to verify that the no-exposure criteria have been met. The City of Portland administers, on behalf of DEQ, the NPDES 1200-Z industrial storm water permits as part of its NPDES Municipal Storm Water Permit program through a Memorandum of Agreement with DEQ.

DEQ has developed a series of five general permits to address the particular industrial activities specified by EPA. These permits are grouped by activities:

- 1200-C for construction activities that disturb one or more acre;
- 1200-CA for public agencies that are involved in construction activities that disturb one or more acres;
- 1200-A for non-mineral mining activities (primarily sand and gravel mining);
- 1200-Z for the remaining industrial activities; and
- 1300-J for facilities with discharges from oil/water separators and other oily discharges.

Key elements of the general storm water permits include:

<u>Storm Water Pollution Control Plans</u>: A Storm Water Pollution Control Plan (SWPCP) must be prepared and submitted to DEQ within 90 days after issuance of a new permit or a renewal permit with new requirements. The SWPCP must include a complete description of the industrial activities at the site along with drainage maps that show the location of facilities, impervious areas, and point source discharges. In addition, the SWPCP must discuss measures that will prevent and/or treat storm water pollution. Except for site controls that require capital improvements, the SWPCP must be implemented within 90 days. Site activities that require capital improvements (*e.g.*, treatment BMPs; manufacturing modifications; pads, dikes, and other structures used for the transfer of storm water; and roofs and appropriate covers for manufacturing areas) must be completed in accordance with the schedule set forth in the SWPCP.

<u>Semi-Annual Monitoring</u>: General storm water permits require semi-annual monitoring for contaminants specified in the permit. The DEQ recommends that monitoring occur in the fall, when runoff first occurs, and in the spring. In addition, visual observations of drainage areas must be made monthly when a precipitation event has produced runoff. Storm water monitoring data are evaluated against benchmarks to assess the effectiveness of the SWPCP. Storm water benchmarks for industrial general permits are set at 130 milligrams per liter (mg/l) total suspended solids (TSS), 10 mg/l oil and grease, 0.1 mg/l total copper, 0.4 micrograms per liter (μg/l) total lead and 0.6 mg/l total zinc. Occasional exceedances of storm water benchmarks have occurred at many facilities within Portland Harbor. However, an exceedance of a benchmark is not a violation. Rather, facilities that exceed benchmarks must review their SWPCP within 60 days of receiving sampling results. The purpose of the review is to determine if the plan is being followed and to determine if any additional site controls are necessary to

improve the quality of storm water discharges. Any newly-identified site controls must be implemented in a timely manner and incorporated into the SWPCP as an update

Best Management Practices (BMPs): SWPCPs must include a description of all storm water BMPs needed to comply with the permit. Permittees are required to maintain exiting controls and/or develop new controls appropriate for the site to minimize the exposure of pollutants to storm water. BMPs must be employed if technically and economically feasible. BMPs are typically required in response to an exceedance of industrial storm water benchmarks in order to improve storm water quality. In addition, the DEQ has the authority to require implementation of additional BMPs to address contaminants detected in storm water or storm water sediment (e.g., catch basin, or conveyance line sediments) above concentrations that suggest an adverse effect on beneficial water uses. DEQ and the City of Portland have developed guidance on BMPs for storm water discharges, which include:

- Containment or storage of all hazardous materials in a manner designed to prevent leaks and spills from contaminating storm water;
- The use of oil/water separators, booms, skimmers, or other methods to eliminate or minimize oil and grease contamination of storm water;
- Proper disposal or recycling of wastes in a manner to eliminate or minimize exposure of pollutants to storm water;
- Erosion and sediment control to minimize sediment loads in storm water discharges;
- Debris control to eliminate or minimize debris in storm water discharges;
- Storm water diversion away from fueling, manufacturing, treatment, storage, and disposal areas to prevent exposure of uncontaminated storm water to potential pollutants;
- Covering of fueling, manufacturing, treatment, storage, and disposal areas to prevent exposure of uncontaminated storm water to potential pollutants;
- Sweeping;
- Loading and unloading materials;
- Emergency response and spill cleanup plans;
- Above ground storage tanks;
- Outside manufacturing activity;
- Vehicle and equipment washing;
- Vehicle and equipment maintenance;
- Sandblasting and painting operations;
- Inspection and monitoring activities;
- Dust control; and
- Erosion and sediment control.

Other SWPCP Requirements: Other SWPCP requirements include the development and implementation of spill prevention and response procedures, preventative maintenance programs, and employee education programs. In addition, SWPCPs require permittees to maintain records of programs and other activities required by the SWPCP, and spills or leaks of material that impacted or had the potential to impact storm water or surface waters.

A.2.3 City of Portland MS4 Program

The 1987 amendments to the CWA required EPA to include non-point source pollution under its permitting program. Phase I of the NPDES Storm Water Program, developed in 1990, requires permit coverage for storm water discharges from medium and large municipal separate storm sewer systems (MS4s) located in incorporated places or counties with populations of 100,000 or more.

The Phase I regulations (40 CFR 122.26(d)(2)) require regulated municipalities to develop adequate legal authority, perform source identification, and develop a management program to reduce the discharge of pollutants to the maximum extent practicable using management practices, control technologies, and system design and engineering methods and other such provisions that are appropriate. With regard to industrial controls, the management plan must include a description of a program to monitor and control pollutants in storm water discharges to municipal systems from municipal landfills, hazardous waste treatment, disposal and recovery facilities, industrial facilities that are subject to section 313 of title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), and industrial facilities that the municipal permit applicant determines are contributing a substantial pollutant loading to the municipal storm sewer system. The program has to: (1) identify priorities and procedures for inspections and establishing and implementing control measures for such discharges; and (2) describe a monitoring program for storm water discharges associated with industrial facilities.

In accordance with the regulatory requirements [40 CFR 122.26(d)], MS4s must:

- Obtain coverage under an NPDES storm water permit; and
- Develop and implement a storm water management program that uses BMPs to effectively reduce or prevent the discharge of pollutants into receiving waters to the "maximum extent practicable."
- The program must include measures to:
  - Identify major outfalls and pollutant loadings;
  - Detect and eliminate non-storm water discharges to the system;
  - Reduce pollutants in runoff from industrial, commercial, and residential areas; and
  - Control storm water discharges from new development and redevelopment areas.

DEQ enforces NPDES regulations in Oregon. On September 7, 1995, DEQ issued a five-year NPDES storm water permit for the Portland urban services boundary to the City of Portland and its co-permittees: Multnomah County, the Port of Portland, the Oregon Department of

Transportation (ODOT), Multnomah Drainage District #1, and Peninsula Drainage Districts #1 and #2.

At the end of the first five-year cycle, the City and its remaining co-permittees (Multnomah County and the Port of Portland) submitted a permit renewal package to DEQ. The permit was renewed for a second term in March 2004. DEQ subsequently reconsidered the second-term permit and reissued a modified permit in July 2005. The permit expires on February 28, 2009.

As part of its MS4 NPDES permit (See Appendix A), the City of Portland has developed a comprehensive storm water management program to reduce the discharge of pollutants into receiving waters to the maximum extent practicable. Key elements of the storm water management program (*i.e.*, source control activities) include:

- Development Standards: The City of Portland developed a storm water manual, which outlines the implementation of measures to control storm water in conjunction with new development or redevelopment projects. The manual was last revised in September 2004 and will continue to be updated as development standards are revised. In addition, the city has developed erosion control guidelines that require all sites with ground-disturbing activities to meet a "no visible or measurable" standard.
- Industrial and Commercial Controls: The city administers NPDES permits on behalf of DEQ, providing oversight for facilities that discharge to the Willamette River and the municipal storm sewer system under the 1200-Z and 1300J- general storm water permits. City oversight includes review of Storm Water Pollution Control Plans (SWPCPs) and technical assistance. SWPCPs must be reviewed, and revised as necessary, in response to an exceedance in storm water benchmarks. The storm water management plan will include additional triggers for the review and revision of SWPCPs.
- Illicit Discharge Controls: The city developed an Illicit Discharge Elimination Program to prevent, identify, and control illicit discharges to the city's storm water systems and surface water. Elements of the program include verification of commercial and industrial connections to the storm system, dry weather monitoring, and evaluation of non-storm water discharges. The city also maintains a 24-hour pollution complaint hotline, at 503-823-7180.
- Structural Controls: The city constructed or upgraded a number of storm water pollution control facilities. In addition, the city encourages activities that control storm water runoff such as routing roof runoff to vegetated swales or other landscape features, replacing pavement with porous materials, and regrading paved areas to prevent drainage to the storm sewer system.
- Operations and Maintenance: The city is currently evaluating a variety of maintenance practices for city buildings, structures, parks, and publicly held rights-of-way.
- Planning/System Preservation and Development: The protection of natural areas can lead to improvements in water quality through restoration of natural functions. Efforts to protect natural areas include the expansion of environmental overlay zones to protect waterways and other natural areas, land acquisition for the purpose of flood

storage and resource protection, and code changes to minimize discharges to the city's storm sewer system.

- Public Involvement and Education: The City of Portland offers a wide variety of public involvement and education programs on storm water to residential, commercial, and industrial users and the general public to control activities that could pollute storm water.

A.2.4 Combined Sewer Overflows

The City of Portland is currently under a 1991 Stipulated Order for the control of combined sewer overflows (CSOs). The order requires the city to control CSOs such that no more than four combined sewer overflows occur annually during the winter and no more than one combined sewer overflow occurs every three years during the summer. The city is required to achieve this performance standard by 2011.

The city's CSO effort has two main elements:

- Inflow Reduction – Remove storm water from the system by separating storm water sewers from sanitary sewers, installing sumps to allow storm water to infiltrate, and encouraging businesses and residents to disconnect downspouts from the storm water system.
- Duplicative Capacity – Create a duplicative system that receives the overflows and routes them to a treatment plant.

Within Portland Harbor, 7 of the 21 outfalls owned by the City of Portland were CSOs. Five of the seven CSOs were located on the east side of the Willamette River in the St. Johns neighborhood. Two of the five are now separated and the other three receive a high level of control. The storm water in the St. Johns area that was separated from the combined system is now discharged through treatment facilities before discharging to the river.

The two remaining CSOs were located on the west side of the Willamette River in the northern portion of Portland Harbor. One of these outfalls has been abandoned and the other may discharge CSO under large rain events. The combined sanitary and storm water flow from these outfall basins is now directed to the Columbia Boulevard wastewater treatment plant.

The majority of outfalls upstream of Portland Harbor are CSOs. These CSOs are expected to be controlled as proposed CSO facilities come online by 2006 (for the west side) and 2011 (for the east side). Key CSO facilities include the Westside CSO tunnel, the SW Parallel Interceptor, and the Eastside CSO tunnel. Because CSO controls have significantly reduced the volume of sewage entering Portland Harbor through the CSO outfalls, DEQ source control efforts will focus on storm water discharges.

A.2.5 Portland Harbor Outfall Project

The City of Portland, in addition to its MS4 permit and CSO order requirements and NPDES activities under the Municipal Storm Water Permit program, entered into an Intergovernmental Agreement (IGA) with DEQ for Remedial Investigation and Source Control Measures of city storm water conveyances within Portland Harbor. The objectives of the RI include: evaluating the potential for upland discharges to contribute to Willamette River sediment contamination; identifying significant sources of upland contaminants being discharged to the river; and collecting and evaluating data for each City outfall to determine whether source control measures are needed.

Under the IGA, BES and DEQ will work together to achieve the following:

- Identify all hazardous substance source areas or discharges to City of Portland (City) owned storm water outfalls in or near the Portland Harbor Initial Study Area ("City outfalls"). Source areas shall be identified through a review of historical information and, when feasible, the collection of environmental samples for chemical, physical, and other analyses. The evaluation of source areas shall focus on upland operations that may have resulted in a release of hazardous substances discharging to the city storm water system.
- Evaluate all contaminant migration pathways to the City's storm water system in or near the Portland Harbor Initial Study Area. Key elements relevant to contaminant migration include, but are not limited to storm water discharge to the City outfall system, and potential groundwater discharge to the outfall system.
- Collect sufficient data and historical information to allow the identification of possible upland areas contributing to sediment contamination adjacent to the City outfalls. Areas of potential sediment contamination shall be characterized through the Portland Harbor Sediment RI/FS. Data collection and evaluation shall consider the potential for contaminant migration to the Willamette River from the City outfalls.
- Generate or use data of sufficient quality for outfall basin characterization, and identifying and developing appropriate upland source control measures. Using BES and DEQ authorities implement or require source control measures to protect river sediment and surface water quality.

The City of Portland outfalls drain approximately 35% of the total area draining to the Portland Harbor ISA. The city has collected information on each of its outfalls within the harbor. This information is summarized in two reports prepared by the city:

- *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area,* (Eastshore), July 2000; and
- *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area,* (Westshore), November 2000.

The Preliminary Evaluation reports contain basin maps, storm water data, and a summary of current and historic operations located within each basin. This basin information is also used to facilitate DEQ site discovery efforts.

The "*Programmatic Source Control Remedial Investigation Work Plan*" (CH2M Hill, 2004) for the City of Portland Outfalls Project describes the City of Portland's approach for evaluating the storm water discharges to the Willamette River through city outfalls. The work plan contains sediment data collected off of 18 city-owned outfalls. This data and the data in the preliminary basin evaluations were used by the City to prioritize the outfalls for further characterization and evaluation.

As part of the RI, the City completed pilot studies of two outfall basins. The pilot focused the identification of COIs, contaminant migration pathways, and upland contaminant sources. In addition, the City performed near-shore sediment sampling, collection of sediment samples from storm water conveyance lines, historical research, contaminant-specific research, storm water inspections, development of catch basin sampling procedures, coordination with DEQ on site discovery efforts, coordination with DEQ Hazardous Waste Technical Assistance personnel, and various other tasks.

Remedial investigation activities on the City outfalls within the Portland Harbor ISA are on-going.

A.2.6 Storm Water Management Planning

DEQ's Cleanup and Water Quality Programs are working together to evaluate regulatory options to prevent storm water discharges from recontaminating Willamette River sediments. Options that are being considered include expanding storm water permitting for unpermitted facilities that discharge storm water to the harbor and developing a new storm water permit that could more effectively monitor and the control the discharge of COIs into Portland Harbor. The DEQ may also consider additional triggers for the review and revision of Storm Water Pollution Control Plans (SWPCPs). Use of DEQ's cleanup authority will also be considered to manage storm water discharges on a site-by-site basis. DEQ will require parties under cleanup agreements to evaluate storm water quality following the "*Framework for Portland Harbor Storm Water Screening Evaluations*" (see Appendix D). In addition, storm water discharges will be monitored to determine if the source control actions taken to control discharges of contaminants are effective in protecting the Willamette River. Enforcement actions may be taken by DEQ's Cleanup or Water Quality Programs, as appropriate, to ensure that the storm water discharges are protective of the river.

A.3 Regulatory Framework for Non-Point Source Discharges

Non-point sources of pollution refer to those pollutants that occur over a wide area and are often associated with particular land uses as opposed to individual point sources like discharges through sewers and pipes. Non-point source pollutants reach the waters of the State through runoff (e.g., stormwater discharge exempt from permit coverage) during rain events or groundwater discharge. Within Portland Harbor, non-point sources are generally limited to groundwater discharge and sheet flow across sites adjacent to the Willamette River. These sources will be evaluated and controlled as necessary through the DEQ upland site assessment and cleanup programs. However, other non-point sources may enter Portland Harbor from upstream areas within the Willamette Basin.

The most common non-point source pollutants are temperature, turbidity, bacteria, and nutrients. Since these pollutants are not hazardous substances they are not addressed in the JSCS. Non-point source pollutants may also include hazardous substances such as pesticides, herbicides, and petroleum products that may enter the Willamette River from urban and agricultural areas.

The DEQ has developed a Non-Point Source Management Plan as required under Section 319 of the Clean Water Act. The goal of this plan is to prevent and eliminate water pollution from non-point sources in all water bodies in the state. The overall strategy of this plan is for DEQ to enhance its own and other agencies' or individual's capabilities for dealing with non-point sources. The plan emphasizes watershed protection and enhancement, voluntary stewardship, and partnerships between all watershed stakeholders. Oregon's strategy includes interagency partnerships between agencies such as the Department of Transportation, Department of Agriculture, and Department of Forestry.

The Non-Point Source Program identified ten elements necessary for an effective non-point-source control/watershed-management program:

1. **Standards:** The desirable and/or minimally acceptable conditions necessary to support sensitive beneficial uses (*e.g.*, standards, criteria, or benchmarks for water quality, erosion, riparian condition, upland vegetation, or other watershed condition parameters).
2. **Assessment:** Condition of the water specifically and of the watershed as a whole, focusing on the standards established above.
3. **Coordinated Watershed Planning:** The joint and cooperative evaluation by all watershed stakeholders of needs, opportunities, constraints, and options for sound watershed management; the production of a practical and implementable action plan.
4. **Education:** The delivery of information about watershed functions, values, conditions, responses, and management techniques; offered to land managers and the general public; intended to direct attitudes, beliefs, and actions toward improved watershed management practice.
5. **Demonstration Projects:** Relatively small-scale projects designed to demonstrate the viability of sound watershed management techniques; sited widely throughout the state to promote best management practices and to help galvanize local activism.
6. **Technical Assistance:** Field-based experts and literature resources provided to help land managers select and implement best management practices suited to their eco-region, land use, style of operation, and other management goals.
7. **Cost-Share Assistance:** Financial assistance and incentives for implementation of watershed enhancement practices on private lands; coupled with contractual agreement by landowners to maintain the enhancements for an extended period.
8. **Stewardship:** The adoption by local groups of responsibility for the condition of their watershed resources; active local promotion of the concept of watershed enhancement and the protection of sensitive beneficial uses.
9. **Watershed Enhancement Projects:** Coordinated enhancement and protection projects covering whole watersheds and sustained over a number of years; perhaps initiated sooner or more densely in higher priority areas but also implemented in every eco-region and geo-political area of the state.

10. **Enforcement:** The field-based capability to investigate and remedy the violation of applicable standards or regulations.

A.4 Regulatory Framework for Prevention of Future Releases

A.4.1 Spill Program

The DEQ has developed hazardous substance spill rules under OAR 340-108 and regulations pertaining to oil spills under OAR 340-047. In addition, the EPA has developed the Oil Pollution Prevention Regulation to address the oil spill prevention provisions in the Clean Water Act. The purpose of state and federal spill requirements are to prevent the spill of oil and other hazardous substances to navigable waters and to identify the emergency response actions, reporting obligations, and follow up actions required in response to a spill or release, or threat of spill or release, of oil or hazardous materials. The DEQ recently revised its spill rules to address oil spill planning, vessel fees, ballast water, and hazardous materials spill guidance.[2]

A.4.2 Spill Prevention

Spills within Portland Harbor present a potential threat to aquatic life, birds, waterfowl and habitat. The great majority of spills involve petroleum products. While some are spills of cargo, many others are spills of a vessel's own fuel. Oil spills to surface water can result from causes as varied as collisions, equipment failure, overfilling of vessel or facility tanks, pumping bilge water contaminated with oil, and other operator error. A spill of a few hundred gallons of oil in a river is a serious matter, and can have effects not only on the environment but also on commerce. In a sufficiently large spill, shipping lanes might be closed in order to avoid contamination and help contain the oil. The volume of petroleum and petroleum products that are handled within Portland Harbor is large. In 1995, the Port of Portland handled more than 6 million tons of petroleum and petroleum products.

As part of the Portland Harbor Source Control Strategy, DEQ will evaluate current practices at upland sites with regard to spill prevention and response to ensure compliance with EPA's spill prevention control and countermeasures program and DEQ's spill prevention and preparedness program. Summaries of these programs are provided below.

A.4.3 EPA Oil Spill Prevention, Control and Countermeasures Program

As a cornerstone of EPA's strategy to prevent oil spills from reaching our nation's waters, EPA requires that certain facilities develop and implement oil spill prevention, control, and countermeasures (SPCC) plans. SPCC plans are required for non-transportation-related facilities that:

- Have an aboveground storage capacity of more than 660 gallons in a single tank, an aggregate aboveground storage capacity of more than 1,320 gallons, or a total underground storage capacity of 42,000 gallons; and
- Could reasonably be expected to discharge oil in harmful quantities into navigable waters of the United States.

[2] See OAR 141, 142, and 143.

Unlike oil spill contingency plans that typically address spill cleanup measures after a spill has occurred, SPCC plans ensure that facilities put in place containment and other countermeasures that would prevent oil spills from reaching navigable waters. The SPCC plans are required to address design, operation, and maintenance procedures established to prevent spills from occurring, as well as countermeasures to control, contain, clean up, and mitigate the effects of an oil spill that could affect navigable waters.

Each SPCC plan, while unique to the facility it covers, must include certain standard elements to ensure compliance with the regulations. An SPCC Plan should include the following information in the sequence outlined below:

- A written description of each spill, corrective action taken, and plans for preventing recurrence for all spill events that occurred within twelve months prior to the effective date of the plan;
- Prediction of the direction, rate of flow, and total quantity of oil that could be discharged where experience indicates a potential for equipment failure;
- A description of containment and/or diversionary structures or equipment to prevent discharged oil from reaching navigable waters; [3]
- Where appropriate, a demonstration that containment and/or diversionary structures or equipment are not practical, a strong oil spill contingency plan, and a written commitment of manpower, equipment, and materials to quickly control and remove spilled oil.
- A complete discussion of the spill prevention and control measures applicable to the facility and/or its operations.

A.4.4 DEQ Spill Prevention Efforts

The Oregon Department of Environmental Quality spills program has developed a prevention and preparedness program. Elements of the program include the following:

- <u>Vessel Plans</u> - Vessels traveling the Columbia and Willamette rivers are required to carry spill response plans that provide clear instructions for dealing with a spill. DEQ reviews and approves the plans. Twenty-four companies have submitted vessel plans to DEQ. Most have contracted with one of several response and cleanup providers.
- <u>Facility Plans</u> - Certain facilities are also required to have oil spill prevention and emergency response plans that are reviewed and approved by DEQ. There are twenty-two such facilities in Oregon, mostly in the Portland area.
- <u>Geographic Response Plans</u> - Geographic response plans detail geographic information, equipment requirements and locations, and preferred response activities for particular sections of the Willamette and Columbia Rivers and the coast. Each plan is for a specific river segment, and includes identification of aquatic and wildlife

[3] For on-shore facilities, one of the following should be used at a minimum: dikes, berms, or retaining walls; curbing; culverts, gutters, or other drainage systems; weirs, booms, or other barriers; spill diversion ponds; retention ponds; sorbent materials.)

habitats and water withdrawal points and uses, resource protection and spill containment strategies, maps, locations of necessary materials, and other information. Geographic Response Plans are developed cooperatively by government agencies, river users, and response providers. Some sections of the rivers do not yet have Geographic Response Plans.

- Drills - DEQ attends scheduled response and cleanup exercises as an observer or active participant. In the next biennium, DEQ expects to attend at least one "major" and four "significant" drills. Responders and DEQ also gain valuable training and insights from actual incidents.

Facilities requiring oil spill prevention and emergency response plans are limited to facilities that:

1. Are located on or near the navigable waters of the state;
2. Produce, store, handle, transfer, process, or transport oil in bulk;
3. Transfer, process, or transport oil in bulk;
4. Are capable of storing or transporting 10,000 or more gallons of oil; or
5. Receive oil from tank vessels, barges, or pipelines.

Plan requirements are specified in OAR 340-047-0150. The following eleven facilities within Portland Harbor have oil spill prevention and emergency response plans:

- Arco,
- GATX (a.k.a., Kinder Morgan),
- McCall,
- ExxonMobil,
- Olympic Pipeline,
- Owens Corning,
- Santa Fe Pacific Pipeline,
- Texaco terminal and pipeline,
- Time Oil Linnton,
- Time Oil Northwest Terminal, and
- The Willbridge bulk fuel facility.

A.4.5 Technical Assistance for Hazardous Waste Management

The DEQ Toxics Use/Waste Reduction Assistance Program (TUWRAP) provides technical assistance to businesses and other organizations throughout Oregon. TUWRAP provides technical assistance to help facilities reduce their use of toxic chemicals and their generation of hazardous waste, and to develop better waste management practices. The program also offers suggestions to help facilities come into compliance with Oregon's Toxics Use Reduction and Hazardous Waste Reduction Act (TURHWRA), and state and federal hazardous waste regulations. The program staff provides free on-site consultations, conducts training sessions, responds to facility inquiries, and implements facility planning and reporting provisions under TURHWRA.

The DEQ will be providing increased technical assistance to facilities within Portland Harbor. Facilities will be identified by SIC code and State Fire Marshall records will be reviewed to prioritize businesses for technical assistance. The focus of the technical assistance will be on activities that are not regulated under hazardous waste regulations. Due to the number of businesses that operate in the vicinity of the harbor, businesses will be targeted on a geographical basis (*e.g.*, by City of Portland outfall basins). Site visits will be conducted and recommendations will be made for implementing improved waste handling procedures. A summary of general practices, successfully implemented BMPs, and practices likely to impact Portland Harbor will be provided in a report prepared for each basin.

A.4.6 Public Education

The DEQ recognizes that educational activities are a key component of an effective source control strategy. Therefore, its technical assistance program will work together with the City of Portland's administration of storm water permits to prevent industrial releases to Portland Harbor via storm water discharges. In addition to working with the industrial community, the DEQ is developing ways to inform the public about methods to prevent contamination from entering the city's storm water system. An example project is the city's Clean River Plan. The Clean River Plan is designed to identify citizen behaviors that are currently causing water pollution in the Portland metropolitan area, develop a strategy to change these behaviors, and identify measures of success. The DEQ expects to make use of local media and its website to encourage individuals to reduce the amount of pollution entering Portland Harbor.

A.5 Other Potential Regulatory Requirements

A summary of key federal, state and local requirements under other laws is provided below. This list is not intended to be comprehensive; it is the PRP's responsibility to comply with all local, state, and federal regulations during investigations and remedial actions.

<u>EPA and Corps Clean Water Act</u>: Section 404 of the Clean Water Act requires approval before the discharge of dredged or fill material into waters of the United States.

<u>US Army Corps of Engineers</u> – Rivers and Harbors Act, Section 10: Various sections within the Rivers and Harbors Act of 1899 establish permitting requirements to prevent unauthorized obstruction or alteration of any navigable water of the United States. This authority covers construction, excavation or deposition of materials in, over or under navigable waters, or any work that would affect the course, location condition or capacity of those waters.

<u>United States Coast Guard</u> – River and Harbors Management Act: USCG has permitting authority over marine events that are of short duration.

Federal Emergency Management Agency – National Flood Insurance Program: The Federal Emergency Management Agency (FEMA) requires the evaluation of the effect of cleanup measures on the 100-year flood plain. Actions that increase the river stage under a base flood condition constitute a floodway encroachment. If a floodway encroachment is anticipated, the encroachment must either be mitigated such that there is no net increase in river stage or the floodway must be modified in consultation with FEMA, the City of Portland Office of Planning and Development Review (OPDR) and Metro.

United States Fish and Wildlife Service – Endangered Species Act, Section 7 and Essential Fish Habitat: Coordination with USFW is required to ensure compliance with the requirements of the Endangered Species Act.

National Marine Fisheries Service – Endangered Species Act, Section 7: Coordination with NMFS is required to ensure compliance with the requirements of the Endangered Species Act.

Oregon Department of Environmental Quality – National Pollution Discharge Elimination System (NPDES): Source control measures that include groundwater extraction and treatment will require a NPDES permit for discharge of treated groundwater to the Willamette River.

Oregon Department of Environmental Quality – Clean Water Act, Section 401: Section 401 of the federal CWA requires that any applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the state must provide the licensing or permitting agency with a certification from DEQ stating that activity meets state water quality standards.

Oregon Division of State Lands – Oregon Removal-Fill Law: Oregon's Removal-Fill Law requires DSL to issue removal-fill permits to conserve, restore, and maintain the health of Oregon's waters.

Oregon Department of Fish and Wildlife – Oregon Removal-Fill Law: DSL coordinates with ODFW during the removal-fill permitting process to evaluate potential impacts on sensitive fish, wildlife, and plant species. ODFW established two in-water work windows for the lower Willamette River: July 1 to October 31 and December 1 to January 31.

City of Portland Office of Planning and Development Review – National Flood Insurance Program: The Office of Planning and Development Review (OPDR) regulate structures and property impacts for activities within the Willamette River floodplain. The City administers the permitting in coordination with FEMA.

City of Portland Office of Planning and Development Review – Greenway Regulations: City of Portland Greenway regulations are in effect along the riparian zone of the Lower Willamette River. Greenway regulations are intended to protect, conserve, enhance, and maintain the natural, scenic, historic, economic, and recreational qualities of lands along Portland's rivers. DEQ and the city are currently working on an intergovernmental agreement to streamline the review process.

Under Oregon cleanup law the on-site portion of DEQ approved remedial or removal actions may be exempt from the permitting and procedural requirements of state and local law. As a result, only the substantive requirements apply. Responsible parties are required to notify and consult with other jurisdictions concerning all permitting and procedural requirements that they propose to exempt, and to demonstrate compliance applicable substantive requirements. Federal permits will generally be required.

A.6 Potentially Applicable Standards and Criteria

This section describes potentially applicable standards and criteria that may apply to Portland Harbor sites.

A.6.1 Ambient Water Quality Criteria

Ambient Water Quality Criteria (AWQC) are established under section 304(a) of the Clean Water Act. They include acute and chronic criteria for the protection of aquatic life, criteria for the protection of human health based on fish consumption, and criteria for the protection of human health based on combined fish and drinking water consumption.

DEQ last revised Oregon's criteria for toxic pollutants in 1991 and is currently in the process of revising the criteria to incorporate the latest scientific information, including the most recent (2002) federally recommended criteria for approximately 167 toxic pollutants. The Oregon Environmental Quality Commission approved the revised criteria on May 21, 2004. However, the EPA must also approve the revised criteria before they become effective. Their decision on the new standards is not expected until 2006.

A.6.2 Narrative Water Quality Criteria:

ORS Chapter 340, Division 41 contains a number of narrative water quality criteria for surface water. Examples of narrative standards potentially applicable to the Portland Harbor Superfund site include:

- The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed;
- The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed;
- Objectionable discoloration, scum, oily sheens, or floating solids, or coating of aquatic life with oil films may not be allowed; and
- Aesthetic conditions offensive to the human senses of sight, taste, smell, or touch may not be allowed.

Exceeding narrative water quality criteria (*e.g.*, a groundwater discharge that contains a noticeable sheen) is a sign of gross contamination and may mean that the contamination poses an imminent threat to human health or the environment.

A.6.3 DEQ Level II Ecological Screening Level Values for Surface Water

Because AWQC are not available for all COIs in Portland Harbor, DEQ developed Level II screening level values (SLVs) for surface water. These can be found in *Guidance for Ecological Risk Assessment* (DEQ, 2001). Level II SLVs are intended for the protection of ecological receptors only and are based on AWQC or surface water criteria developed by the Oak Ridge

National Laboratory (ORNL). These SLVs were developed for screening purposes only and are not promulgated standards.

A.6.4 Level II Screening Level Values for Freshwater Sediment

DEQ's *Guidance for Ecological Risk Assessment* (DEQ, 2001) provides Level II SLVs for freshwater sediment. The Level II SLVs for freshwater sediments are based on a number of published data including:

- Threshold Effects Levels (TELs) developed by the National Oceanic and Atmospheric Agency (NOAA), Coastal Resource Coordination Branch (1999);
- Upper Effects Threshold (UELs) developed by the National Oceanic and Atmospheric Agency (NOAA), Coastal Resource Coordination Branch (1999);
- Threshold Effects Concentrations (TECs) developed by Smith, MacDonald, Keenleyside, Ingersol, and Field (1996); and
- Lowest Apparent Effects Thresholds (LAET) developed by the state of Washington Department of Ecology (1997).

These SLVs were developed for screening purposes only and are not promulgated standards.

A.6.5 Evaluation of PBTs

The bioaccumulation of contaminants from sediment through the food chain into fish or shellfish may pose a threat to humans or wildlife that consume fish. In addition, OAR 340-122-084(2)(d) and OAR 340-122-084(3)(d) require that special attention be given to chemicals capable of bioaccumulation.

A.6.6 Background Concentrations

DEQ uses naturally occurring background concentrations to evaluate sediment data. Although no background metals data are currently available for Portland Harbor, background sediment concentrations developed by the U.S. Geological Service (USGS) and background soil concentrations developed by state of Washington Department of Ecology for Clark County[4] may be used to provide an initial comparison to natural background levels. Final background levels for the Portland Harbor in-water cleanup will be developed in the Portland Harbor RI/FS.

[4] See www.ecy.wa.gov/programs/tcp/pu94115.htm.

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Appendix B

DEQ Identification of Potential Upland Contaminant Sources

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Appendix B DEQ Identification of Potential Upland Contaminant Sources

B.1 Background

This Appendix describes the Oregon Department of Environmental Quality's (DEQ) process for identifying potential sources of contamination to Willamette River within the Portland Harbor Superfund site and is provided for informational purposes only.

Under the Memorandum of Understanding (MOU), DEQ is responsible for the identification and control of contaminant sources to Portland Harbor. The United States Environmental Protection Agency (EPA) is responsible for investigating the nature and extent of in-water contamination, estimating the risks to human health and the environment from exposure to the in-water contamination, identifying and evaluating remedial action alternatives, and selecting a remedial action to address in-water contamination.

The EPA has entered into an Administrative Order on Consent (AOC) with a group of responsible parties known as the Lower Willamette Group (LWG). Under the terms of the AOC, the LWG is responsible for the performance of a remedial investigation and feasibility study (RI/FS) that addresses the in-water portion of the site. The work plan for the RI/FS was approved by EPA in April 2004.

This Appendix supports the Joint Source Control Strategy and identifies how DEQ will identify potential upland sources of contamination threatening the river as required by the MOU. DEQ will require individual upland potentially responsible parties (PRPs) to identify, evaluate, and control, to the extent feasible, the release of contaminants to Portland Harbor. This appendix contains the framework for identifying sources. Appendix B describes DEQ's expectations for characterization of sites identified as potential sources.

B.2 Sources of Contaminants in Sediment

Potential sources of hazardous substance that may impact the river include but is not limited to:

- Upland sites being investigated under DEQ Cleanup Authority (ORS 465);
- Overwater activities;
- Permitted and unpermitted storm water discharges;
- Other permitted discharges;
- Overland run-off and other non-point sources;
- Direct discharges resulting from spills and other over or in-water releases; and
- Upstream releases, emissions and discharges.

Examples of Potential Contaminant Sources

- Historic Waste Disposal: Historic waste disposal practices (e.g., spills, disposal ponds, land filling). Hazardous substances that may reach the Willamette River via bank erosion, storm water runoff, or leaching to groundwater.
- Spills and Leaks: Releases from pipelines, tanks, or drums are examples of unpermitted sources that may occur at any time and enter the river through a variety of pathways.
- Ongoing and Historic Harbor Operations: Releases during loading and unloading, refueling, or ship maintenance activities may result in the direct discharge of petroleum products and other materials.
- Point Sources: Permitted and unpermitted discharges through pipes to the river. Permitted discharges include storm water, industrial process water, non-contact cooling water, boiler blowdown water, and treated groundwater discharges.
- Non-Point Sources: Non-point sources are limited within the harbor. Contaminants from non-point sources within the boundaries of Portland Harbor are generally from riverbank erosion or sheet flow across properties located directly on the river.

B.3 Contaminants Detected in Portland Harbor Sediment

Contaminants that have been detected in sediment samples from Portland Harbor, prior to completion of the Round 2A sediment sampling performed by the LWG in the Summer of 2004, include but is not limited to the following:

- Metals: Arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc have been detected throughout the harbor. Elevated metal concentrations have been detected in ship berth slips, adjacent to current and historic ship maintenance operations (*e.g.*, Mar Com Marine, Willamette Cove, and Portland Shipyard), and near some of the municipal outfalls. Elevated levels of organo-tin compounds were detected adjacent to current or former ship maintenance operations.

- Polynuclear Aromatic Hydrocarbons (PAHs) and Semivolatile Organic Compounds (SVOCs): SVOCs (primarily PAHs) have been detected throughout Portland Harbor. The highest concentrations are generally found downstream of RM 7.5. Facilities in this reach of the river that may have contributed to PAH sediment contamination include McCormick and Baxter, GASCO, and numerous bulk fuel facilities that line the Willamette River from RM 4 to RM 8. PAHs are also common constituents in urban storm water runoff and are associated with oil, coal, creosote, and a variety of petroleum products.

- Chlorinated Pesticides: DDT and its breakdown products, DDE and DDD, are the most commonly detected chlorinated pesticides within Portland Harbor. Although they have been detected throughout Portland Harbor, sediment concentrations are highest downstream of the ATOFINA and Rhone Poulenc sites, both former pesticide manufacturers.

- Chlorinated Herbicides: Limited data are available for chlorinated herbicides within Portland Harbor. 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-dichlorophenoxy butyric acid (2,4-DB) were detected downstream of the Rhone Poulenc site, a former herbicide manufacturer.

- Polychlorinated dibenzo-p-dioxins and furans (PCDD/PCDF): These compounds have been detected in Portland Harbor sediment. Most samples have been collected adjacent to the Rhone Poulenc and McCormick and Baxter sites, which are known upland sources of PCDD/PCDF contamination.

- Phthalates: Phthalates are found throughout the harbor. They are associated with plastics and may be associated with urban storm water runoff.

- Total Petroluem Hydrocarbons (TPH): Facilities in the ISA that may be contributing to TPH sediment contamination include McCormick and Baxter, GASCO, and numerous bulk fuel facilities that line the Willamette River from RM 4 to RM 8. TPH is likely a constituent in urban storm water runoff and is associated with gasoline, diesel, oil, coal, creosote, and a variety of other petroleum products.

- Polychlorinated Biphenyls (PCBs). PCBs have been detected throughout Portland Harbor.

- Other. Additional contaminants have been detected in soil or groundwater at upland facilities, including perchlorate, benzene, toluene, chlorobenzene, and hexavalent chromium. As additional contaminants are identified through the upland investigations, additional in-water sampling be needed to assess potential impacts to the Willamette River.

Detailed information on sediment data, including location maps, is available in the Portland Harbor RI/FS Work Plan (LWG., 2004a) and the Field Sampling Plan (LWG., 2004c). Additional sediment samples will be collected by the LWG as the in-water remedial investigation continues. Data from those samples may result in an expansion of the contaminant list summarized above.

B.4 Contaminants Detected at Upland Sites

Contaminants of interest (COIs) for the upland investigations include any hazardous substance that may have been used, stored, or generated during current or historic operations at site. COIs are identified during site investigations and are based on current or historic use of hazardous substances at a facility and on existing upland soil, groundwater, or other environmental data. Sediment data collected adjacent to upland sites as well as chemical fate and transport properties (e.g., breakdown products, geochemistry) will also be considered when identifying COIs.

COIs, at upland sites[1], detected to date include PAHs, PCBs, PCDD/PCDF, pesticides, phenols, phthalates, total petroleum hydrocarbons (TPH), aromatic and chlorinated volatile organic

[1] The latest update of this table is available on DEQ's Website at http://www.deq.state.or.us/nwr/phsummary.pdf.

compounds (VOCs), herbicides, organo-tin compounds, and metals. Some COIs are present at a limited number of upland sites and may still pose localized risks in Portland Harbor. These COIs include, but are not limited to:

- Perchlorate;
- Hexavalent chromium; and
- Trichloroethene (TCE) and its associated breakdown products.

B.5 Upland Site Investigation Process

In general, DEQ's site discovery (i.e., site identification process) process started by broadly looking at current and historic facilities with the Portland Harbor Basin. Facilities with current or historic business operations or processes that could potentially release hazardous substances into the environment are captured as "potential sources." DEQ staff examines sites where releases of hazardous substances have occurred or may have occurred, to determine if these sites have the potential to impact human health or the environment. DEQ's site identification process is described in the following sections.

DEQ's Site Assessment Components Are:

- Discovery
- Site Screening
- Preliminary Assessment
- Expanded Preliminary Assessment
- Remedial Investigation
- Entry into DEQ ECSI Databas

B.5.1 Site Discovery

Discovery refers to how DEQ staff learns of contaminated or potentially contaminated properties. DEQ evaluates many property types, from small commercial lots to roadside chemical spills to large industrial facilities. DEQ assesses all hazardous substances that can contaminate soil, surface water, sediments, groundwater, or air.

During site discovery, DEQ performs quick reviews of readily available site information and identify those sites with the greatest potential to threaten human health and/or the environment. At this time, DEQ adds new sites to DEQ's Environmental Cleanup Site Information (ECSI) database[2]. ECSI is an electronic tracking system for contaminated or potentially contaminated sites, which is updated as sites progress through different stages of the cleanup process.

Potential upland sources of contamination within the Portland Harbor Basin are identified by using multiple sources of information, including but not limited to the following:

[2] ECSI can be searched using DEQ's website at http://www.deq.state.or.us/wmc/ECSI/ecsiquery.htm.

- Referrals from other DEQ programs or from other public agencies;
- Evaluation of Willamette River sediment data;
- Contamination appearing on adjacent properties;
- Data submitted voluntarily by property owners or their representatives;
- DEQ staff research to discover sites that could affect Vulnerable Areas including review of DEQ files and databases including but not limited to the following:
  - Identification of facilities immediately adjacent to the river;
  - Identification of facilities within private and municipal storm water drainage basins;
  - Cleanup Files; Site Assessment Files;
  - Water Quality files;
  - Spill reports;
  - Citizen complaints;
  - Hazardous Waste Generator files;
  - Solid Waste Files;
  - Underground Storage Tank files;
  - Air Quality files, and
  - Field Reconnaissance (visual identification);
- Other federal, state, or local government records including:
  - EPA CERLIS information;
  - Oregon State Fire Marshall List;
  - Historic maps or aerial photographs; and
  - City of Portland Storm water Inspection/monitoring reports.

Based on the results of DEQ's site discovery process, sites are selected by DEQ staff for further evaluation based on known information and best professional judgment of potential threats or current or historical releases from these facilities. Sites that are found to be or are suspected to be contaminated by hazardous substances are then prioritized for further DEQ assessment.

DEQ initiated an extensive site discovery program in 1998 and continues to identify potential sources through its Site Assessment (SA) and Portland Harbor Cleanup Sections. The discovery activities initially focused on facilities along the banks of the Willamette River within the boundaries of the 1997 Portland Harbor Site Investigation (Weston, 1997) and in the Rivergate district located downstream from river mile 3.5 on the east side of the river. Site discovery activities are currently focused on facilities within City of Portland municipal storm water conveyance basins within the ISA.

B.5.2 Preliminary Site Screening

Site Assessment's first documented action at a site is called a **screening**. A screening is a brief review of readily available information on site history, contamination, and ways that human or environmental receptors could be exposed to site contamination. Screenings are primarily "desktop" exercises that occasionally include site visits, but rarely involve DEQ sampling. Typically, at this stage, DEQ will issue an information request letter in accordance with its cleanup authority, to obtain information regarding current and historic use of hazardous substances. Screenings culminate in general recommendations for further site action that include priority rankings. Screenings are usually documented in written DEQ Strategy Recommendations.

Strategy recommendations are based on a detailed review of existing information. The goal is to determine whether a specific hazardous substance release or a specific past operation at the site has impacted, has likely impacted, or has the potential to impact media at the site. For the purposes of this source control strategy, the evaluation is focused specifically on the potential for impacts to Willamette River sediments.

DEQ strategy recommendations include detailed information on the following:

- Site description;
- Operational and regulatory history;
- Evaluation of current and historical uses of the property (Note: the history of Portland Harbor sites is typically reviewed back to the early 1900's);
- Results of any environmental investigations performed at the site;
- Summary of DEQ program files;
- An evaluation of potential exposure pathways; and
- Recommendations for further action.

Conclusions and recommendations for next steps are also provided in the strategy recommendation. Sites are scored using DEQ's site assessment prioritizing system (SAPS) to determine their priority for additional investigation. Priorities (low, medium, or high) are assigned based on the threats posed by contamination and the urgency for implementing further remedial actions. Sites with the potential for contaminant discharges to Portland Harbor are identified as high priority sites. Those without the potential for ongoing contaminant discharges to the harbor are evaluated based on the potential threats to upland receptors.

Depending on the amount of information available and the nature of site contamination, DEQ may recommend that the property owner conduct a Preliminary Assessment (PA), a PA with sampling (a.k.a., expanded PA or XPA), a site investigation (SI), a remedial investigation (RI), or an RI with a feasibility study (FS) to evaluate cleanup options. At some sites, all that is needed is further documentation or analysis to demonstrate that hazardous substances pose no significant threats. At a few other sites, DEQ staff may be able to determine from existing documentation that no further action is necessary. Depending on site conditions and the assigned priority, DEQ may offer facility owners and operators the following options for further action: 1) participate in DEQ's Voluntary Cleanup Program; 2) conduct further actions independently (i.e., without DEQ involvement); or 3) wait for DEQ's Site Response Section to initiate further action under the state's enforcement authority (high priority sites only).

Site screening efforts within Portland Harbor initially focused on shoreline sites located between RM 0.5 and RM 11. In order for sites that are set back from the Willamette River to be sources of contamination to the river sediment, a contaminant migration pathway must exist from the site to the river. As discussed in Section B.4.1, primary migration pathways to the river include storm water or surface water discharges, groundwater migration, and preferential pathways along utility lines. For sites set back from the Willamette River shoreline, the primary migration pathway is expected to be storm water. As a result, current DEQ site discovery activities are focused on non-shoreline sites that discharge to public and private storm water conveyance systems.

B.5.3 Preliminary Assessments

At high priority sites where a release may have occurred or the threat of a release exists, DEQ staff will conduct or require a PRP to conduct a Preliminary Assessment (PA). This involves a detailed evaluation of the facilities current and historical operational history, waste management practices, identification of potential source area; past sampling data (if available), and potential exposure pathways. PAs incorporate site visits and sometimes include limited sampling. However, sampling at this stage more commonly occurs during an Expanded Preliminary Assessment (XPA), which is designed to confirm the presence of contamination when a previously completed PA lacks such information.

The information collected during a PA is used to reassess the potential for the site to adversely impact the Willamette River. If it appears that a site may be impacting the river, DEQ will assign a high priority to the site and require additional investigation by means of an XPA or a RI (described below). High priority XPAs or RIs are conducted either under voluntary agreements or enforcement orders as discussed in Sections B.5.4 and B.5.5, respectively.

Medium or low priority sites are allowed to perform the work independently or through the DEQ Voluntary Cleanup Program. DEQ will not typically take enforcement action at low or medium priority sites, if the responsible parties refuse to perform the necessary work. However, the DEQ will continue to re-evaluate these sites as more information becomes available and can change the site priority if warranted.

B.5.4 Preliminary Assessment with Sampling

If additional data are needed to determine if a facility is a current source of contamination to the river, DEQ will require the upland responsible party to perform a preliminary assessment with sampling (XPA). If an upland PRP refuses to perform a preliminary assessment, the DEQ will use its enforcement authority to compel the required work or will declare the site a DEQ orphan site, and then perform the work using its environmental contractors.

The XPA should identify all upland, in-water, and over-water activities that might have resulted in the release of hazardous substances. Sufficient samples should be collected to determine if a release of hazardous substances has occurred and if they pose a potential threat to the river and its sediment. If so, DEQ will assign a high priority for a RI as described in Section B.5.5.

If it can be demonstrated based on the results of the XPA that a facility is not an ongoing (i.e., current) source of contamination to the river, DEQ may reprioritize the site and issue a determination stating that source control measures are not required at this time. The site will then be referred to the DEQ cleanup program to address upland issues unrelated to Portland Harbor and to EPA for evaluation of potential historic sources of in-water contamination.

B.5.5 Remedial Investigation and Source Control Measures

A **remedial investigation** (RI) is a detailed study that may includes groundwater, soil, sediment, or surface water sampling to determine the nature and extent of contamination at a site. The RI emphasizes data collection and site characterization including sampling and monitoring as necessary to gather sufficient information to determine the necessity for remedial action and to support the risk assessment which estimates risks to human health and the environment as a result of the contamination. The RI also provides site-specific information to evaluate cleanup alternatives evaluated in a Feasibility Study (FS) or Source Control Evaluation (SCE).

DEQ has initiated approximately 60 RIs in the Portland Harbor area. Upland RIs started since 2000 are generally performed under a Voluntary Cleanup Agreement and Scope of Work (SOW) developed specifically for Portland Harbor sites in accordance with the MOU. The RI agreement requires PRPs to perform an upland RI designed to characterize all sources and pathways of contamination to the Willamette River and to evaluate, design, and implement necessary source control measures (See Section 4.0 of the JSCS). Site characterization elements required by DEQ for Portland Harbor sites are discussed in Appendix C.

The Portland Harbor RI agreement distinguishes between the upland and in-water portions of the cleanup site and explicitly states that the portion of the site below the mean high-water mark of the Willamette River should be excluded from this work. The in-water portion of the investigation will take place under EPA oversight in accordance with EPA's AOC with the LWG for the Portland Harbor Sediment RI/FS.

Although many elements of the RI are focused solely on the upland portion of the site, the SOW requires the evaluation of all contaminant migration pathways at the site, particularly those related to the Willamette River. This may include the collection of sediment and/or pore water data from below the high-water mark[3] to characterize and evaluate groundwater or storm water discharges to the river.

The RI should include two distinct elements: (1) the investigation and assessment of upland contamination unrelated to Portland Harbor, and (2) the identification and characterization of sources and pathways of contamination to the river and sediment. It is beyond the scope of this source control strategy to outline the process for upland investigations unrelated to Portland Harbor. However, specific site characterization elements required by DEQ for Portland Harbor sites are discussed in Appendix C.

High priority remedial investigations are performed under DEQ voluntary agreements or enforcement orders. If the PRP refuses to perform the RI, DEQ will issue a unilateral order for the performance of the necessary investigation and cleanup work, as discussed in Volume 2 of the JSCS. If the RP refuses to comply with the unilateral order, DEQ has the options of

[3] For Portland Harbor upland projects, DEQ has chosen to provide an initial definition of an upland harbor site boundary using one elevation for consistency and to minimize gaps in river bank evaluations. DEQ's initial definition is 8 feet Columbia River Datum (9.85 feet National Geodetic Vertical Datum) as measured on the USGS Morrison Bridge river gauge. This starting point elevation definition should be combined with site-specific discretionary modifications.

enforcing the order, declaring the site an orphan site and performing the work itself, or referring the site to EPA. If DEQ performs the removal or remedial action, the RP will be liable for the cost of the action, plus punitive damages equal to three times the amount of the state's costs.

B.5.6 DEQ Environmental Cleanup Site Information (ECSI) Database

A site is added to DEQ's Environmental Cleanup Site Information (ECSI) Database when DEQ learns that it is contaminated or potentially contaminated with hazardous substances such as solvents, metals, PCBs, or petroleum hydrocarbons. Such site information comes from a number of sources, as described in Section B.5.1. Because ECSI includes *potentially* contaminated sites as well as sites known to be contaminated, appearance on the ECSI database does not necessarily mean that a site is contaminated.

For tracking contaminated sites, DEQ's ECSI database can be considered roughly equivalent to EPA's *CERCLIS* database. However, there are important differences between the two:

1. In contrast to ECSI, CERCLIS is a formal, statutory list that sets in motion certain required activities and timelines.

2. EPA generally adds sites with *confirmed* contamination to CERCLIS, while DEQ adds to ECSI sites with *suspected* contamination as well as those with confirmed contamination.

3. Unlike ECSI, CERCLIS specifically excludes sites with petroleum-only contamination.

4. All CERCLIS (or former CERCLIS) sites in Oregon are added to ECSI, but most ECSI sites are not added to CERCLIS.

5. EPA's cleanup process uses an "all or nothing" approach – following EPA evaluation, sites in CERCLIS are either proposed for the Superfund list or designated as No Further Remedial Action Planned ("NFRAP"), and transferred to the CERCLIS archives. On the other hand, Oregon recognizes a continuum of site cleanup needs and priorities and will often determine that federal NFRAP sites require further state action.

B.6 Identification and Control of Upstream Contaminant Sources

Existing sediment data and sediment data collected during the Portland Harbor RI/FS will be evaluated to determine if upstream sources are contributing significantly to contamination of the harbor sediment. Data to be evaluated include upstream and reference site sediment samples, and storm water and other discharge data generated through DEQ's Water Quality program. If it is determined that upstream contributions could result in the recontamination of Portland Harbor following remediation activities, or otherwise represent a threat to human health and the environment, DEQ will work with the appropriate regulatory authorities to identify and control specific sources of the contamination. Potential upland sources that will be considered include storm water discharges, DEQ cleanup sites, non-point sources, etc.

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Appendix C

DEQ Characterization of Potential Upland Contaminant Sources

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Appendix C DEQ Characterization of Potential Upland Contaminant Sources

This Appendix describes DEQ's general process for characterizing potential upland contaminant sources within the area of the Portland Harbor Superfund site and provides general considerations for developing upland conceptual site models. This approach should be viewed as a dynamic, flexible process that can and should be tailored to the specific circumstances of individual sites. The goal is to conduct efficient and effective investigations that achieve high quality results in a timely and cost-effective manner.

Site characterization will be required for sites identified as a high priority by DEQ. In general, site characterization activities will be conducted in accordance with EPA's "*Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*[1]" and the objective of the RI/FS process is not the unobtainable goal of removing all uncertainty, but to gather information sufficient to support an informed risk management decision. This Appendix focuses on the evaluation of the groundwater and stormwater contaminant migration pathways.

C.1 DEQ Portland Harbor Remedial Investigations

Upland characterization activities typically begin during the expanded preliminary assessment (XPA) or in the initial phases of the remedial investigation (RI). A RI is a detailed study that may include groundwater, soil, sediment, stormwater, and surface water sampling to determine the nature and extent of contamination at a site. The RI emphasizes data collection and site characterization including sampling and monitoring as necessary to gather sufficient information to support the risk assessment which estimates risks to human health and the environment as a result of the contamination and to determine the necessity for remedial action.

During the RI, the full nature and extent of upland contamination should be defined. In order to complete an acceptable XPA or RI, site characterization activities should be conducted in accordance the DEQ agreement[2], applicable DEQ and EPA guidance, and a DEQ-approved work plan(s). In addition, reports documenting investigation rationale, procedures, and results should be required for the administrative record to support remedial action and source control decisions.

In general, a site characterization should result in a complete description of the following:

- Evaluation of current and historical uses of the property (Note: the history of Portland Harbor sites should typically be documented back to the early 1900's if possible);
- Current and historic potential sources of contamination (including overwater facilities);
- Regulatory compliance history (*e.g.*, NPDES, RCRA, Air Quality);
- Environmental setting (*e.g.*., site hydrogeological conceptual model);

[1] Interim Final. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01. October 1988. EPA/540/G-89/004.

[2] The boilerplate for an RI investigation agreement is available at http://www.deq.state.or.us/wmc/documents/RI-FS-SOW(long).pdf.

- Contaminants of interest;
- Extent of impacted media (soil, storm water, surface water, groundwater, air);
- Potential contaminant migration pathways and receptors; and
- Contaminant fate and transport.

The Portland Harbor RI agreement distinguishes between the upland and in-water portions of the cleanup site and e states that the portion of the site below the mean high-water mark of the Willamette River may not be included in this work. The in-water portion of the investigation will generally take place under EPA oversight in accordance with EPA's Agreement on Consent (AOC) with the Lower Willamette Group (LWG) for Portland Harbor Sediment RI/FS.

DEQ's Portland Harbor upland RI scope of work (SOW) requirements differs from DEQ's standard RI/FS SOW in a number of ways. Some key differences are:

- <u>Site Characterization</u>: The full characterization of all hazardous substance source areas at the facility is required. In addition, PRPs are required to evaluate all contaminant migration pathways with a focus on those pathways that may result in hazardous substance releases to the Willamette River. Because work below the mean high-water mark of the river is excluded, DEQ will not generally require in-water characterization activities unless necessary to properly evaluate contaminant migration pathways, establish contaminant concentrations at the in-water point of exposure, or evaluate, design and implement source control measures.

- <u>RI Off-ramp</u>. During the RI process if it can be demonstrated that a facility is not an ongoing (i.e., current) source of contamination to the river, DEQ may reprioritize the site and issue a determination stating that source control measures are not required at this time. The site will then be referred to the DEQ cleanup program to address upland issues unrelated to Portland Harbor and to EPA for evaluation of potential historic sources of in-water contamination.

- <u>Land and Beneficial Water Use</u>: The identification of land and beneficial water uses associated with the Willamette River are specifically excluded.

- <u>Risk Assessment</u>: The risk assessment is limited to upland human health and ecological risk assessments.

- <u>Evaluation and Implementation of Source Control Measures</u>: The site characterization must be adequate to evaluate, design, and implement necessary source control measures. Source control measures must address contaminant migration to the river that warrants removal action under OAR 340-122-0070 (See Section 4.0 of the JSCS).

- <u>Feasibility Study</u>: A feasibility study is not included. The upland SOW contemplates the implementation of source control measures as a *removal* action. If necessary, feasibility studies would be completed under a separate agreement with DEQ.

Although many elements of the RI are focused solely on the upland portion of the site, the SOW requires the evaluation of all contaminant migration pathways at the site, particularly those related to the Willamette River. This may include the collection of sediment and/or pore water data from below the high-water mark[3] to characterize and evaluate groundwater or storm water discharges to the river.

The RI should include two distinct elements: (1) the investigation and assessment of upland contamination unrelated to Portland Harbor, and (2) the identification and characterization of sources and pathways of contamination potentially impacting the river. These elements are described in the following sections.

C.2 Conceptual Site Model Development

Prior to initiating the RI, it is very important for the PRP and DEQ to develop a working hypotheses of the chemical and physical processes controlling contaminant fate and transport and how potential receptors might be exposed to site contaminants. The conceptual site model (CSM) describes upland sources, contaminants of interest (COI), site geology, hydrology, hydrogeology, contaminant migration pathways, and contaminant fate and transport. The risk assessment exposure conceptual site model (ECSM) describes potential routes of exposure to potential site receptors. These conceptual site models are briefly described below.

C.2.1 Conceptual Site Model

The CSM incorporates physical and chemical information to understand contaminant fate and transport and potential impacts to the river. Development of the CSM is an iterative process beginning with a conceptual understanding of the hydrogeological and hydrological system at the site and ending with a detailed understanding of site-specific conditions governing contaminant fate and transport through pathways which may impact the river. The CSM should include information on the following:

- Current, historical, and potential future sources of contamination;
- COIs;
- Physical (*e.g.*, density and viscosity) and chemical characteristics (*e.g.*, solubility, K_{oc}, K_{ow}) of the COIs;
- NAPL properties and anticipated behavior (*i.e.*, mobility), if relevant to the site;
- Site geology and hydrogeology including physical characteristics (*e.g.*, grain size, K_d,, f_{oc}) of the site;
- Site surface water hydrology (*e.g.*, description of site storm water flow and management);
- Assumed distribution of COIs based on site conditions (geology, hydrogeology, hydrology, land use, type of release, area of release, size of release, age of release, *etc.*);

[3] For Portland Harbor upland projects, DEQ has chosen to provide an initial definition of an upland harbor site boundary using one elevation for consistency and to minimize gaps in river bank evaluations. DEQ's initial definition is 8 feet Columbia River Datum (9.85 feet National Geodetic Vertical Datum) as measured on the USGS Morrison Bridge river gauge. This starting point elevation definition should be combined with site-specific discretionary modifications.

- Factors that influence groundwater discharge to surface water (*e.g.*, tidal effects, sediment type in discharge zone, geochemistry);
- Potential points of exposure;[4]
- Representative geologic cross sections[5] parallel and perpendicular to the groundwater flow direction. These figures should illustrate:
  - Site topography and river bathymetry;
  - Extent of primary geologic units;
  - Location of contaminant sources;
  - Monitoring well depths, screened intervals, and representative concentrations;
  - Utilities or other potential preferential pathways;
  - Vertical and horizontal delineation of groundwater plume(s) either as contours or the expected extent of contamination; and
  - Groundwater flow direction (vertical and horizontal).
- Site maps that illustrate the following:
  - Site layout (location of contaminant sources, well locations, proximity to the river, storm water drainage systems, outfalls, etc.);
  - Representative concentrations in each medium;
  - Delineation of extent of contamination in each medium (surface soil, subsurface soil, groundwater (each zone of concern), sediment, either as contours or the expected extent of contamination; and
  - Subsurface utility corridor maps.

Periodically the data collected during the RI/FS process should be checked against the CSM and the CSM refined as needed to more accurately describe contaminant distribution and transport. The CSM should be used to help focus data collection on the key information needed to complete delineation of the nature and extent of contamination and to gather information sufficient to support an informed source control or risk management decision.

C.2.2 Exposure Conceptual Site Model

Another critical step in the site characterization and risk assessment process is the development of a site exposure conceptual site model (ECSM). This model should show the link between potential sources, contaminant migration pathways and potential exposure pathways to human and ecological receptors. An iterative process should be used to develop the ECSM, starting with an understanding of the hydrogeological and hydrological system at the site (see Section C.2) and then incorporate a thorough understanding of potential exposure pathways and receptors. The ECSM should be revised throughout the investigation as data are developed and finalized for the baseline risk assessment. For further discussion on ECSM development, refer to

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[4] The CSM development should be conducted concurrently with the Risk Assessment exposure conceptual site model.

[5] Geologic interpretation must be performed by an Oregon Registered Geologist or an Oregon Licensed Professional Engineer (PE). Documents, reports, containing this information must be signed and stamped in accordance with Oregon regulations (ORS 672.525).

DEQ's *Guidance for Ecological Risk Assessment*[6] and the *Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites.*[7]

C.3 Groundwater to Surface Water Pathway Considerations

Contaminated groundwater discharging to Willamette River sediments and surface water poses a potential threat to human health and the environment. Therefore, during Portland Harbor upland investigations the following questions should be considered periodically throughout the project to assure adequate characterization of the nature and extent of contamination and to aid in source control decisions:

C.3.1 Upland Considerations

Upland Groundwater Extent of Contamination

- Can the upland groundwater plume be delineated to appropriate screening levels (e.g., chronic AWQC or MCLs)?
- What additional work is needed to complete the upland delineation of groundwater investigation?
- Are additional upland wells needed to define the vertical or horizontal extent or evaluate additional source areas? If so, are these wells currently planned?
- Are additional rounds of groundwater elevation or quality monitoring needed to evaluate temporal trends (*i.e.*, verify steady-state conditions)?
- Do we sufficiently understand groundwater flow (including seasonal or tidal changes)?
- Has the contamination been delineated to sufficiently predict where the plume may discharge into the river?
- Have potential geologic controls on groundwater contaminant migration (water bearing zones, aquitards, perched groundwater, basalt) been adequately identified and evaluated?
- Have potential preferential groundwater flow paths (natural or man-made) been identified and evaluated?
- What COIs are may be impacting the river?
- If groundwater concentrations exceed source control SLVs are source control alternatives being evaluated? If so, what types of actions are being considered and what data is needed for design?
- Is there sufficient data to evaluate plume stability or to assess future conditions? How will plume stability be evaluated? Do we have sufficient data to determine if the plume is stable or if it may reach the river at some point in the future (does it present a potential threat to the river)?

Nonaqueous Phase Liquid (NAPL)

- Is LNAPL or DNAPL present? Where?

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[6] Available on-line at http://www.deq.state.or.us/wmc/cleanup/ecocover.htm

[7] Available on-line at http://www.deq.state.or.us/wmc/tank/rbdm.htm

- Have the physical and chemical properties of the NAPL been characterized?
- Is the extent of NAPL defined?
- Is the NAPL potentially mobile?
- Is the NAPL recoverable?

Groundwater Seeps

- Have groundwater seeps been identified?
- Have groundwater seeps been characterized (e.g., contaminant concentrations, discharge rates, loading to river)?

C.3.2 Transition Zone Considerations

- What data is needed to determine if groundwater is discharging to the river and where (i.e., GW discharge mapping)?
- Is sufficient groundwater data available such that the DEQ project team can provide recommendations to EPA for in-water groundwater sampling (e.g., core locations, porewater sampling locations)?
  - If no, when will the project be at that point - what data is needed to get there?
  - If yes, what data are necessary to define the nature and extent of contamination, confirm the site hydrogeologic CSM, determine if source control is needed, and to perform a "localized" ecological risk assessment?
    - Updated HCSM- Evaluate existing upland data and offshore sediment data and core logs to project stratigraphic or water bearing zones into the river (*i.e.*, revise HCSM and prepare cross sections extending into the river showing bathymetry and stratigraphy).
    - Off-shore borings to define stratigraphy in the river. What is the expected depth of these cores?
    - Off-shore borings to collect groundwater grab samples to track groundwater contamination to into the river to define extent of contamination, groundwater flow paths, and help identify potential groundwater discharge areas.
    - Groundwater discharge mapping (towed probes, Trident Probe grid sampling) in area of expected groundwater discharge or preferential flow pathways to:
      1) Identify potential transition zone water (*i.e.*, porewater) quality sampling locations.
      2) Identify potential areas to measure groundwater discharge rates (flux).
      3) Provide understanding of groundwater discharge to evaluate the results of the in-water surface and sediment sampling locations (i.e., are existing sediment sample locations in the right locations to utilize "bulk" sediment results to evaluate the groundwater pathway).
- Does sufficient transition zone data (i.e., porewater) exist in groundwater discharge areas to:
  - Define the nature and extent of groundwater contamination.
  - Determine exposure point concentrations for ecological risk assessment.
  - Identify potential locations for additional site specific surface water sampling.
- Has groundwater flux been quantified to:
  - Characterize groundwater discharge zone.

- Estimate potential contaminant loading to river.
- Identify areas that may require early action or source control measures.

C.3.3 Groundwater to Surface Water Characterization Techniques

Within Portland Harbor, groundwater flow is generally towards the Willamette River. Although flow reversals from surface water to groundwater may occur in response to a rapid rise in surface water elevation, these effects are generally of short duration. Flow within the Willamette River, water occurs not only in the open stream channel but although through the underlying sediment. This region, where surface water and groundwater mix, is known as the *hyporheic* zone. The hyporheic zone is a region of biological productivity that serves as habitat for benthic organisms and a source of food for bottom feeding fish. As a result, characterizing groundwater discharges to the Willamette River is a critical part of developing an understanding of potential affects of groundwater contamination on in-water receptors. This information is also needed to design and implement source control measures. Methods for the additional characterization of the groundwater/surface water interactions can include, but is not limited to the installation of:

- Push-probe sampling devices to collect groundwater data from beneath the river;
- Seepage meters to estimate groundwater flux to or from the river;
- Seepage meters to evaluate quality of water discharging to surface water; and
- Diffusion-based sampling devices to identify contaminated groundwater discharge points or identify preferential groundwater migration pathways.

A summary of some techniques is provided below:

Groundwater Direction

Initial upland characterization should focus on obtaining groundwater level measurements to map the hydraulic gradient across the site. Groundwater levels should be measured relative to Willamette River levels. Due to the potential for rapid changes in Willamette River levels as a result of storm events and tidal fluctuations, continuous water level monitoring may be required to understand how groundwater levels respond to these changes. Off-shore characterization of the potentiometric head associated with groundwater beneath the river may also be needed to understand the rate and direction of groundwater flow to the river. Mini-piezometers, and in some cases, nested clusters of mini-piezometers, can be used to collect this information.

Groundwater Flux

Although chemical concentrations are typically used in risk assessments or for comparison to benchmarks, contaminant flux is also useful for evaluating source control measures. Qualitative assessments of groundwater flux can be identified by monitoring for and observing changes in groundwater and surface water temperatures and conductivity. The relative changes of these parameters can be used to map out where groundwater flows into the surface water and where the flow is reversed.

Groundwater flux to surface water can be estimated from water level measurements or measured with seepage meters, which are specifically designed to measure the volume of water flowing through the sediment/surface water interface. Simple seepage meters can be constructed from a 55-gallon drum cut in half. A Teflon® or Tedlar® bag is attached to the closed end of the drum through a water-tight fitting that penetrates the drum. The open end of the drum is inserted into the sediment. Groundwater flux is measured from the volume of water that flows into the bag after a known period of time.

Transition Zone Water Quality

Measurement devices for assessing Transition zone (i.e., porewater) water quality may be divided into two categories, passive and active sampling techniques. In addition to analyzing samples for contaminants of interest, other field parameters such as pH, temperature, specific conductance, dissolved oxygen, and common anions and cations as tracers should also be performed.

Passive Sampling Devices.

Passive sampling techniques involve the placement of a sampling device in sediment or in the water column and allowing that device to equilibrate over time. The time required for equilibrium is dependent on the contaminants of interest. Passive devices result in quantitative or semi-quantitative results. The characteristics of the receiving body, site lithology and the nature of the contaminant plume are used to select appropriate placement location and depth. Passive devices include semi-permeable membrane devices, diffusion samplers, and peepers.

Semi-permeable membrane devices (SPMDs) are designed to gather time-integrated data on aquatic contaminants over a period of days to weeks. SPMDs are typically constructed of low density polyethylene and are designed to mimic the bioconcentration of organic contaminants in the fatty tissues of organisms. SPMDs are generally installed in the water column. If diffusion constants are available for the COIs, SPMD data can be used to calculate water column concentrations.

Diffusion samplers include water-to-vapor diffusion and water-to-water diffusion devices. These devices are typically used for VOCs as an indirect measurement of aqueous concentrations. However, these devices only provide semi-quantitative information and are typically used for the identification of groundwater plumes discharging to surface water. The devices are installed by burying them at the desired depth and location and allowing them to equilibrate over time.

Peepers are subsurface chambers for sampling a variety of dissolved contaminants. Peepers are most often used for metals, although they have been used successfully to characterize volatile organic compounds. A mesh or semi-permeable membrane is placed across an opening in a chamber, which is buried, much like the diffusion-based devices, until equilibrium is reached. Peepers can also be used to assess biological exposures to pore water. The primary disadvantage associated with the use of peepers is membrane clogging.

Active Sampling Devices

Active sampling devices are designed to collect a representative sample of pore water or groundwater. The devices are similar to monitoring wells in that a water sample is obtained from below the sediment-water interface. Active sampling devices include mini-piezometers, direct-push devices, and multi-level sampler devices.

Direct-push techniques such as the Geoprobe® may easily be adapted to obtain groundwater samples off-shore of upland facilities. Geoprobe® rigs are typically mounted on work barges and floated into place. A drive point sampler is driven to the desired depth and an interstitial water sample is withdrawn and sent for analysis. Another approach is the use of a mini-piezometer such as the MHE Push Point Sampling Device. The device is a rigid 1/8-inch diameter stainless steel probe that can be used to collect shallow water samples. Although it can be deployed easily in shallow water, divers must be present to use the device in deeper waters such as those that exist in Portland Harbor.

In some cases, drivable multilevel samplers may also be deployed. These devices are similar to direct-push or mini-piezometers except that they allow for the collection of samples at multiple depths.

C.4 Storm Water to Surface Water Pathway Considerations

Permitted and unpermitted storm water discharges may represent a significant pathway of contamination to river sediments at sites where runoff comes into contact with contaminated media. These discharges should be evaluated and controlled to the extent feasible in order to prevent significant sediment recontamination and to protect water column organisms from adverse effects.

C.4.1 Upland Considerations

During Portland Harbor RI upland investigations the following questions should be considered periodically throughout the project to assure adequate characterization of the nature and extent of contamination and to aid in source control decisions:

- Is storm water system adequately understood (*e.g.,* basin delineation, conveyance lines, potential source areas, COIs)?
- Have the types, concentrations, and variability of hazardous substances (including Persistent, Bioaccumulative and Toxic pollutants (PBTs) such as PCBs and phthalates) in storm water discharges (both liquid and solid) been adequately characterized?
- Can storm water discharges be defined to appropriate screening levels (*e.g.*, chronic AWQC or MCLs)?
- What additional work is needed to complete the storm water investigation?
- Are sampling events needed or different sample types (whole water, sediment traps, conveyance line sediments) to define the extent of contamination or to refine the understanding of source areas? If so, is this sampling currently planned?
- Are contaminants being discharged to the river as dissolved phase? Particulates? Both? Is additional information, needed for source control decisions? Recontamination decisions?
- Are discharge measurements needed to estimate or quantify potential contaminants loading to the river?
- Is the variability in storm water quality and quantity sufficiently understood to determine if source control is needed or if best management practices (BMPs) are effective?
- Do the storm water conveyance lines contain accumulated sediments that may be acting as an ongoing source of contaminants to the river?
- Should the storm water conveyance system (*e.g.,* catch basins and lines) be inspected and/or cleaned to eliminate potential source material?
- Does the storm water system potentially serve as a preferential groundwater flow pathway? If so, has this potential been evaluated?

- If storm water concentrations exceed source control SLVs are source control alternatives being evaluated? If so, what types of actions are being considered and what data is needed for design?
- Have the effectiveness of Best Management Practices (BMPs) been determined and the need for additional source control evaluated?

C.4.2 Storm Water Characterization Techniques

Storm water discharges are highly variable both in terms of flow and pollutant concentrations. Based on the intermittent discharge periods and unknown pollutant and sediment loads associated with storm water, a conservative approach is used in the JSCS for screening. The purpose of this approach is to identify potentially significant contaminant sources of hazardous substances (*i.e.*, dissolved or sediment loads) to the river.

Piped storm water or sheet flow discharges have the potential to suspend and transport soil (including catch-basin or conveyance line sediment) into the river, especially during storm events. Particulates settling out of storm water discharges may represent a source of contaminant loading to river sediment, therefore cumulative sampling approaches may be required (*e.g.*, sediment traps).

It is assumed that upland sites will perform both storm water (liquid phase) and storm water sediment (solid phase) sampling and analyses during upland investigations. DEQ's "*Framework for Portland Harbor Storm Water Screening Evaluations*" (December 2005; see Appendix D of the JSCS) provides guidance for sampling storm water and catch basin samples. The specific objectives of this framework are to:

1) Provide acceptable sampling procedures and sampling frequencies, consistent with the JSCS, for characterizing storm water discharges (*i.e.*, liquid and particulate transport) to the Willamette River through individual or shared storm water conveyance systems; and

2) Provide consistency in storm water collection and evaluation between individual Portland Harbor facilities through implementation of this framework.

In addition to the evaluation described in the framework, additional sampling may be required to assess the variability in storm water quality (whole water) or to evaluate stormwater sediments to either estimate contaminant loading to the river or to evaluate the potential for stormwater to recontaminate sediments in the Willamette River after implementation of in-water cleanup activities. Possible methods for evaluating stormwater sediments include:

- Catch basin (manholes, sumps, etc.) sediment sampling;
- Conveyance line sediment sampling;
- Sediment traps; and/or
- Filtered effluent from the whole water phase.

Analytical testing requirements should be based on:

- Site-specific contaminants of interest (COI);
- Portland Harbor Willamette River data (*e.g.*, surface water or sediment) supporting a specific suite of COIs;
- Facility NPDES permit parameters; and
- Other applicable regulatory requirements (*e.g*. whether the facility discharges to an impaired (303(d) listed) water body, available or proposed Total Maximum Daily Loads (TMDLs)).

In addition, additional analysis may be needed for quantify organic carbon, total suspended solids, sediment grain size, etc.

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Appendix D

Framework for Portland Harbor Storm Water Screening Evaluations

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Appendix D Framework for Portland Harbor Storm Water Screening Evaluations

D.1 Introduction

A detailed understanding of storm water discharge quality and quantity to Portland Harbor is needed to evaluate potential adverse impacts to the Willamette River. This information will be utilized to identify, prioritize, and implement storm water source control measures to prevent contamination of river sediments and recontamination of river sediments following the Portland Harbor clean up.

Over 250 private and public storm water outfalls have been identified within the Portland Harbor initial study area (ISA). Given the commercial/industrial nature of upland development within this area, storm water is a potentially significant mechanism for transporting contaminants from upland sites to the Willamette River. The storm water pathway evaluation and screening process described in this document has been designed as a first step towards characterizing storm water impacts on Willamette River sediment and water quality from upland sites being investigated under Oregon Department of Environmental Quality (DEQ) cleanup authority[1].

D.1.1 Purpose

The purpose of this document is to provide DEQ Cleanup Program project managers with a framework for overseeing the development of site-specific work plans for evaluating the storm water pathway at Portland Harbor upland sites (including both permitted and unpermitted facilities) and public outfalls. This framework includes information regarding adequate characterization for screening current storm water discharges from cleanup sites (*e.g.*, sampling procedures, sampling frequencies, storm event criteria) and is intended as a companion document to the Interim Final "*Joint Source Control Strategy*" (JSCS) for Portland Harbor prepared by DEQ and Region X of the U.S. Environmental Protection Agency (EPA) (DEQ/EPA, 2005). The JSCS provides a detailed discussion of the storm water screening process including screening level values (SLVs), source control prioritization, and weight-of-evidence evaluations to determine if source control is needed under the JSCS. This document is intended as guidance for employees of DEQ and is presented as framework or method that others may use for that purpose, if appropriate. Its use, however, is not required.

Storm water discharges are highly variable both in terms of flow and pollutant concentrations. Based on the intermittent discharge periods and unknown pollutant and sediment loads associated with storm water, a conservative approach is used in the JSCS for screening. This approach is used to identify potentially significant hazardous substance sources (*i.e.*, dissolved or sediment loads) to the river.

[1] Oregon Revised Statute (ORS) 465.200 et seq. and Oregon Administrative Rules (OAR) 340-122-0010 to 0140.

Piped storm water or sheetflow discharges have the potential to suspend and transport soil (including catch basin or conveyance line sediment) into the river, especially during storm events. Particulates settling out of storm water discharges may represent a source of contaminant loading to river sediment, therefore cumulative sampling approaches may be required (*e.g.*, sediment traps). This document relies on the use of catch basin sediment to initially screen potential particulate input to the river, alternative methods (*e.g.*, sediment traps, sampling of sediments accumulated in conveyance lines; high-volume filtering of storm water discharges) may be proposed. DEQ may require some sites, based on the results of storm water screening and other site -specific information, to characterize storm water sediments in a more quantitative way to assess contaminant loading to the river. DEQ may develop additional information (*e.g.*, guidance, fact sheets) for DEQ project managers regarding potential sampling methods, loading calculations, or evaluating sediment recontamination from upland sources.

Upland sites with potentially complete storm water pathways will be selected for storm water screening evaluation, based on DEQ's site discovery process (see Appendix B of the JSCS) or site-specific information (*e.g.*, Willamette River sediment data, National Pollutant Discharge Elimination System (NPDES) monitoring results, intra-agency referrals, conveyance line data or facility sampling, spill history, inspections, etc.).

Evaluating storm water discharges is considered a high priority in the JSCS and should be addressed in early 2006 and 2007 to allow completion of upland source control decisions and to provide needed data to the in-water remedial investigation (RI).

D.1.2 Background

Available Willamette River data indicate that sediments are contaminated with metals (*e.g.*, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), semivolatile organic compounds (SVOCs), phthalates, chlorinated pesticides (*e.g.*, DDT, DDE and DDD), chlorinated herbicides, polychlorinated dibenzo-p-dioxins and furans (PCDD/PCDF), total petroleum hydrocarbons (TPH), and polychlorinated biphenyls (PCBs) (See Appendix B of the JSCS). Detailed information on sediment data is available in the Lower Willamette Group's (LWG) *Portland Harbor RI/FS Programmatic Work Plan* (LWG, 2004a) and the City of Portland's *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project* (CH2M Hill, 2004).

Of the 250 outfalls identified in the Portland Harbor ISA, approximately 100 upland facilities are subject to/covered by NPDES storm water permits Industrial storm water permits are required for specific industry classifications as established by EPA. These include individual permits, 1200-Z general permits, and 1300-J permits for the discharge of storm water from facilities storing, transferring, formulating and/or packaging bulk petroleum products. The City of Portland administers NPDES 1200-Z and 1300-J storm water permits within the City limits under a Memorandum of Agreement (MOA) with DEQ (See Appendix A of the JSCS). A number of shoreline and upland sites do not have storm water discharge permits because there is no exposure of activities or the activities described for their operations do not match the specific federal Standard Industrial Classification (SIC) codes that require a permit. Storm water monitoring required by these NPDES permits does not include the broad suite of contaminants typically detected in Willamette River sediment.

The City of Portland and co-permittees Port of Portland and Multnomah County implement storm water management programs under a permit issued by DEQ under the federal Clean Water Act (CWA). The permit is formally called the Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. DEQ issued the first-term permit to the City in 1995 and issued the final second-term permit in July 2005. In August 1991, the City of Portland signed an agreement with DEQ (amended in 1994) that established a schedule to eliminate combined sewer overflows (CSOs) to the Willamette River by 94 percent by the end of 2011.

D.1.3 DEQ's Regulatory Authority

DEQ regulates storm water discharges under its Water Quality program (See Appendix A of the JSCS). DEQ's Water Quality rules[2] state:

> *Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.* OAR 340-041-0033

In addition, Oregon's Narrative Water Quality Criteria (OAR Chapter 340, Division 41) prohibit the creation of: 1) tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish; 2) objectionable discoloration, scum, oily sheen or floating solids or coating of aquatic life with oil film; 3) aesthetic conditions offensive to the human senses; and 4) formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry.

DEQ's Environmental Cleanup rules provide a conditional exemption to permitted releases of hazardous substances into the environment, except as provided below:

> *These rules do not apply to permitted or authorized releases of hazardous substances, unless the Director determines that application of these rules might be necessary in order to protect public health, safety or welfare, or the environment. These rules may be applied to the deposition, accumulation, or migration resulting from otherwise permitted or authorized releases.* OAR 340-122-0030[3].

[2] Oregon Administrative Rules (OAR) Chapter 340, Division 041, Section 0033
[3] Oregon Administrative Rules (OAR) Chapter 340, Division 122, Section 0030

Available data suggest contaminants are accumulating in Portland Harbor sediments and aquatic tissue that may adversely affect public health, safety or welfare, or the environment. Therefore, DEQ is requiring upland facilities (including public outfalls) being investigated under DEQ's cleanup rules to fully characterize and evaluate potential hazardous substance discharges to the Willamette River via groundwater, storm water, or soil erosion. This data may be required by DEQ under preliminary assessments with sampling (XPAs) or RIs.

It is DEQ's intent that data collected under Cleanup Program authorities will meet NPDES monitoring requirements and be acceptable to the Water Quality Program, as discussed in Subsection 3.2. DEQ's Water Quality Program will be proposing changes to 1200-Z permits, in 2006. These changes can be tracked on DEQ's website: http://www.deq.state.or.us/wq/wqpermit/stormwaterhome.htm.

D.1.4 Objectives

The goal of this document is to provide DEQ Cleanup Program project managers with a framework for overseeing the development of storm water work plans for evaluating storm water discharges from upland facilities in Portland Harbor. The specific objectives of this framework are to:

1) Provide acceptable sampling procedures and sampling frequencies, consistent with the JSCS, for characterizing storm water discharges (*i.e.*, liquid and particulate transport) to the Willamette River through individual or shared storm water conveyance systems; and

2) Provide consistency in storm water collection and evaluation between individual Portland Harbor facilities through implementation of this framework.

Data obtained from work plans and fieldwork implemented in accordance with this framework will be screened against Portland Harbor screening level values (SLVs) as defined in the JSCS. In addition, the data will be used to:

1) Determine the types, concentrations, and variability of hazardous substances (including Persistent, Bioaccumulative and Toxic pollutants (PBTs) such as PCBs and phthalates) in storm water discharges (both liquid and solid) from upland facilities to the Willamette River;

2) Determine if storm water discharges potentially impair the identified beneficial uses of the Willamette River;

3) Identify upland facilities that may require further investigation of potential impacts associated with storm water discharges or may require source control; and

4) Assess the effectiveness of Best Management Practices (BMPs) and determine if addition additional source control measures might be needed.

This framework addresses current, ongoing releases only. It does not purport to make conclusions regarding historical discharges to the receiving water body that may have occurred via the storm water system.

The following sections present the types of information that should be included in an upland work plan for evaluating the storm water pathway at a cleanup site within the Portland Harbor study area. This document is presents an acceptable framework for storm water screening; other methods may be used for that purpose, if appropriate, and approved by DEQ.

D.2 Site Information

The initial step in developing a storm water characterization work plan is collecting and documenting basic site information. That information will provide the framework for selecting catch basin sediment and storm water monitoring parameters for the screening evaluation.

D.2.1 Potential Contaminant Sources

Potential current and historic contaminant sources should already have been identified during the preliminary assessment (PA) or remedial investigation (RI)[4]. Taking the following steps will help to identify potential storm water contaminant sources:

- Evaluate the site from a storm water perspective – identify areas of industrial storm water run-on and runoff;
- Review current and historic site operations (*e.g.,* manufacturing or other industrial processes, transportation-related activities, equipment or vehicle maintenance or washing, outdoor storage, on-site waste disposal, dust or particulate generating activities);
- Review the site regulatory history *(e.g.,* pre-treatment requirements, permits, spills, inspections, enforcement actions);
- Evaluate current and historic[5] uses of the property;
- Review the site materials inventory (*e.g.*, fuels, solvents, detergents, plastic pellets, metallic products, hazardous substances, transformers, fertilizers, pesticides, ash, slag, sludge, etc.). The State Fire Marshal's Community Right-to-Know hazardous substance database can be used, along with facility inventory records.
- Review the results of any environmental investigations performed at the site;
- Review federal, state and local spill databases;
- Review the results of catch basin solids waste disposal characterizations;

[4] DEQ's PA and RI process is described in the Appendix B of the JSCS.
[5] The history of Portland Harbor sites is typically reviewed back to the very early 1900's.

- Review DEQ program files (*e.g.,* air, water, storm water, underground storage tank, cleanup, underground injection control point); and
- Review of City of Portland program files (*e.g.,* storm water, plumbing records, etc.).

Information regarding potential current and historic contaminant sources (*e.g*., potential source, contaminant(s) associated with potential source, estimated volume, storage method, period used) should be tabulated and the location of each potential source should be shown on an appropriate site plan.

D.2.2 Facility Storm Water System

Maps and figures should be developed to illustrate and evaluate current and historic site features and facility storm water drainage. The following DEQ and City of Portland resources may have specific drainage information: PAs, RIs, facility as-built drawings, plumbing records, NPDES Storm Water Permit and monitoring reports, Storm Water Pollution Control Plans, and City Storm Water Inspection Records, etc.

The site storm water map prepared for this evaluation should include:

General Site Data:

- Property line and adjacent streets;
- Buildings/structures (onsite and adjacent properties);
- Surface water bodies;
- Paved/unpaved areas; and
- Locations of current and historic industrial activities (*e.g.,* fueling stations, loading and unloading areas, vehicle or equipment maintenance areas, waste disposal areas, storage areas, non-storm water discharges).

Facility Drainage Data:

- Catch basins;
- Storm water conveyance lines (including pipe diameter, connections, invert elevations);
- Discharge points ("outfalls" or connection to shared conveyance line);
- Drainage areas and impervious nature of each outfall and catch basin;
- Direction of storm water flow; and
- Structural control measures (any constructed features to control storm water flow such as berms, retention/detention ponds, vegetative swales, sediment traps, ditches, oil-water separators, etc.).

The description of the site storm water drainage system should be verified through facility inspection records and/or dye testing, if necessary. In addition, available storm water system construction data and site hydrogeologic data should be assessed to determine if the storm water system (both the piping and backfill materials) might intercept and preferentially transport contaminated groundwater. If it is determined that the storm water may provide a preferential pathway for groundwater contaminant migration, DEQ may require additional work under upland agreements to assess the groundwater pathway.

D.2.3 Current Site Storm Water Controls

Preventative measures (largely nonstructural practices) or control measures (structural practices) implemented at the facility (including public outfalls) to reduce storm water contamination should be presented the work plan. That information is needed to understand current site conditions and will likely be used in making source control decisions. Information sources regarding potential site storm water controls may include facility records, DEQ Water Quality files, and City of Portland industrial files, and may include the following:

- Storm Water Pollution Control Plans;
- Storm Water Best Management Practices;
- Spill Prevention and Response Procedures; and
- Preventative Maintenance Programs.

Preventative measures are typically management techniques that reduce the exposure of storm water to potential contaminants. Examples of preventative measures a facility may implement include:

- Employee education and training programs: proper material handling, storage, and disposal practices; alternative materials; toxic use reduction; spill prevention and response, etc.;
- Debris Removal: catch basin cleaning and parking lot sweeping etc.;
- Exposure Reduction: limiting exposure of materials that are potential contaminant sources to rainfall or runoff; reducing and covering inventory installing secondary containment for hazardous liquids, etc.; and
- Runoff Diversion: channeling runoff away from contaminant sources.

Control measures are used to reduce the level of contaminants in storm water and may include filtering, settling, or biological uptake. These are usually engineered systems (*e.g.*, oil/water separators; constructed wetlands; swales). Design documents should be available for review.

The efficiency and effectiveness of preventative or control measures is dependent on system design, implementation, and operation and maintenance. Therefore, it is important that design documents, available system monitoring data, and system operations and maintenance records be obtained and reviewed to assess the potential effectiveness of these measures. Regular maintenance and cleanout of storm drain inlets (*e.g.*, catch basins) has been shown to reduce contaminant loading. Therefore, facility record keeping may be an indicator of the effectiveness of preventative or control measures.

D.3 Sample Analyses Parameter Selection

D.3.1 General Considerations

The site information collected and reviewed as described in Section 2 provides the framework for selecting parameters for monitoring catch basin sediment and storm water quality and locations for characterizing the storm water pathways. The resulting upland site storm water data will be screened against the Portland Harbor SLV defined in the JSCS. Appendix B of the JSCS describes DEQ's process for identifying and screening potential current and historical releases of hazardous substances.

Available site information, including NPDES storm water permit limits or benchmarks, should be incorporated in the selection of screening parameters. This coordination should allow the screening evaluation conducted under the cleanup program to fulfill the monitoring requirements of the industrial NPDES permit. A site's specific catch basin sediment and storm water monitoring parameters may include or be based upon:

- Site-specific contaminants of interest (COI);
- Portland Harbor Willamette River data (*e.g.*, surface water or sediment) supporting a specific suite of COIs;
- Facility NPDES permit parameters; and
- Other applicable regulatory requirements (*e.g.* whether the facility discharges to an impaired (303(d) listed) water body, Total Maximum Daily Loads (TMDLs)).

Additional information regarding the general categories of potential storm water parameters is presented below for DEQ Cleanup program project managers.

D.3.1.1 Site-Specific and Portland Harbor COIs

Evaluating the contribution of storm water to the measured sediment contamination in Portland Harbor or the impacts to water quality in the Willamette River requires storm water discharge data for both site-specific and Portland Harbor COIs. Site-specific COIs are developed from the general site information described in Section 2 and DEQ's Preliminary Assessment (PA) and Remedial Investigation (RI) process.

The ongoing RI[6] of Willamette River sediment and water quality is generating data characterizing the nature and extent of contaminants within the Portland Harbor initial study area. The available RI data (*e.g.*, Round 1 fish tissue data, Round 2 sediment data) supports a more comprehensive suite of parameters during the storm water screening process than site-specific information alone. PBT compounds such as PCBs, dioxins, and mercury, as well as metals, pesticides and herbicides, and polycyclic aromatic

[6] The Portland Harbor RI is being performed by the Lower Willamette Group (LWG) under EPA oversight.

hydrocarbons (PAHs) have been detected in sediment and fish tissue and identified as potential contaminants of concern for Portland Harbor. Attachment A presents a fact sheet that identifies potential sources of PCBs in the environment. Information similar to that in the fact sheet should be considered when developing COI and sampling parameters.

D.3.1.2 NPDES Permit Parameters

The NPDES 1200-Z industrial storm water general permits include benchmarks for total copper, total lead, total zinc, pH, total suspended solids (TSS), and total oil & grease. Facility-specific discharge limitations vary for individual NPDES permits.

D.3.1.3 Other Regulatory Programs

In addition to the site-specific concerns, broader regulatory objectives may warrant inclusion of other parameters to assess potential pollutant contributions to the Willamette River. For example, the Willamette River was listed as "impaired" under Clean Water Act § 303 (d) in 1996, requiring the DEQ to develop a water quality improvement plan. The Lower Willamette River[7], river miles 0 to 24.8, is currently listed for:

- Temperature;
- Fecal coliform;
- Aldrin;
- Dieldrin;
- DDT;
- DDT metabolites;
- Polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs);
- Pentachlorophenol;
- Mercury; and
- Manganese.

Currently, TMDLs have been proposed for mercury, bacteria and temperature in the Willamette Basin. Screening for mercury could support mercury reduction goals under the TMDL.

D.3.2 Catch Basin Sediment Sampling and Analyses Parameters

Catch basin sediment screening is intended to precede the storm water screening, so that analytical results from the catch basin screening can be used to help develop and refine the site-specific storm water analytical suite. Fine-grained sediments may be useful in screening for some hydrophobic compounds such as PCBs and SVOCs. The analytical suite for catch basins should be based on the information gathered during the site information review as well as overarching programmatic concerns. At this stage, it is

[7] The EPA approved DEQ's 2002 303(d) list on March 24, 2003.

recommended that upland sites conduct a broader suite of analyses for each relevant site-specific pollutant category (*e.g.*, priority pollutant metals, SVOCs) rather than to narrow the list to individual constituents.

At a minimum, the following information, when available, should be considered when developing site-specific COIs for catch basin sediment sampling (See Appendix B of the JSCS for additional information):

- Contaminants associated with current and historical operations;
- Materials stored on site and their potential for release;
- Hazardous and solid wastes generated on-site and their potential for release;
- Knowledge of historical contaminant releases (spills, leaks, dumping, etc.);
- Nature and extent of contamination;
- Facility drainage system and proximity of catch basins to potential contaminants;
- Results from waste disposal characterization of catch basin cleaning solids;
- Compliance history with regulatory permits (wastewater pretreatment, storm water permits, air, etc.);
- Storm water permit monitoring results and requirements;
- 303(d) listings;
- Applicable TMDLs; and
- Available Portland Harbor sediment, surface water, or tissue data.

Laboratory reporting limits should achieve the JSCS SLVs to meet the established data quality objectives (DQOs) and to facilitate data evaluation in the context of both the site itself and within Portland Harbor.

D.3.3 Site-Specific Storm Water Sampling and Analyses Parameters

Parameters for the initial round(s) of storm water sampling and analyses should be developed on a site-specific basis, based on consideration of available information, including the following:

- Site-specific COIs;
- Site-specific catch basin sediment data (or other available storm water sediment data);
- COI fate and transport (*i.e.*, would the COI be more likely transported in storm water in a dissolved or solid phase);
- NPDES permit parameters and other potential regulatory requirements; and
- Portland Harbor sediment, surface water, or tissue data in the vicinity of the site's outfalls or shared conveyances.

Site-specific COIs should be determined based on a review of available site data and the potential for contaminants to be transported via storm water. One of the objectives of storm water sampling is to determine whether or not storm water discharges are or may be contributing PBTs to the Willamette River. Historical analytical data may not exist for some COIs identified during the site information review process, therefore, analyses for these compounds may help to remove these COIs from future consideration. Analyzing both catch basin solids and storm water discharges from the same sampling location may help to better understand the storm water pathway and the relationship between catch basin solids and storm water discharge. However, direct sampling of storm water sediments (in-line sediment trapping or high-volume filtered samples) will provide more pertinent data for evaluating whole water samples and evaluating mass loading.

Catch basin sediment data (or other storm water sediment data) should be utilized as a tool in the developing of the parameter list for site storm water evaluations. Storm water sample analyses should consider parameters detected in catch basin sediment above JSCS SLVs. The absence of a certain pollutant in catch basin sediments may not warrant its exclusion from storm water monitoring, but it may support a weight of evidence determination to eliminate it from further consideration when viewed in the context of current and historic facility operations.

Field parameters, such as pH, conductivity, and temperature, can be useful to the data interpretation process. Including these field tests in the analytical suite may allow correlation of screening level exceedances to specific operations or runoff characteristics if multiple measurements are made during the course of a storm event.

Following collection and screening of representative site data, including soil, groundwater, storm water, and catch basin sediments, the list of parameters for storm water analyses may be reduced for additional rounds of sampling, if determined appropriate by DEQ. Upland site owners, operators and/or their representatives may recommend changes to the future monitoring or sampling events. Such changes would need to be approved by DEQ's Cleanup program project manager.

Laboratory reporting limits should achieve the JSCS SLVs to meet the established data quality objectives and to facilitate data evaluation in the context of both the site itself and Portland Harbor generally. If storm water samples are intended to satisfy NPDES permit monitoring requirements, the DEQ Cleanup Program project manager should verify before sample collection that the suggested methods will be acceptable to the DEQ's Water Quality program.

D.4 Catch Basin Sediment Sampling Design

DEQ's fact sheet on basic catch basin design and effectiveness is presented in Attachment B for informational purposes. The City of Portland, Bureau of Environmental Services has developed Standard Operating Procedures (CH2M Hill/COP, 2005) for the sampling of catch basin solids (see Attachment C). Refer to this document for components of an acceptable catch basin sediment sampling plan; other methods or approaches may be acceptable, if approved by DEQ.

D.4.1 Catch Basin Sediment Sampling Locations

Evaluate the facility drainage diagram, Storm Water Pollution Control Plan (SWPCP), and site storm water inspection records to locate all potential points of entry for site sediment into the storm water collection system. Some facilities have multiple catch basins, clean outs, and sediment traps while others may have few or none. Refer to the facility storm water map (see Subsection 2.2) to identify locations that may contain potential COIs based on current or historic operations. Ideally, representative-sampling locations[8] will be available for all site drainage areas with potential COIs.

Certain structures may be more difficult to sample than others due to structure, access, or operations. Field verification of all potential sampling locations is recommended, so any necessary access issues may be resolved prior to mobilizing the sampling crew.

D.4.2 Catch Basin Sediment Sampling Frequency

Catch basin sediments represent a time-integrated snapshot of potential sediment discharge to the river. If the first round of catch basin sediment sampling indicates JSCS SLV exceedances, additional sampling events may be performed to assess sediment quality variability, source identification, or to assess BMP or corrective action effectiveness. Initial catch basin sediment sampling results (*e.g.*, quarterly, semi-annual) may also provide baseline concentrations for evaluating BMP effectiveness and mass-load reductions. In addition, results from catch basin sediment sampling may be used to help refine the analytical suite for site storm water discharge sampling and future catch basin sediment sampling. Use of in-line sediment trap sampling, in conjunction with or instead of catch basin sampling may provide data to trace contaminant sources, evaluate mass loading, and assess potential impacts to the river.

D.4.3 Catch Basin Sediment Sampling Methods

The methodology for catch basin sediment sampling will depend on the structure of the catch basins, the expected presence or absence of standing water, and the characteristics of the sediment itself (*e.g.*, density, moisture content, grain size). Refer to Attachment C for information on sample method selection.

The catch basin sediment sampling work plan should address equipment selection, preparation and decontamination, collection and handling procedures, and sample documentation. Implementation of these protocols will be critical to the collection of representative samples that meet the established objectives.

[8] NPDES 1200-Z permittees have selected “representative” catch basins for storm water sampling, based on the areas where industrial activities take place and industrial materials are stored and handled. These selected catch basins are identified in the facility’s storm water plan approved by DEQ’s Water Quality Program.

D.4.4 Field Documentation

Comprehensive field documentation should be made to aid in the interpretation of analytical results. At a minimum, field documentation should include a description of the catch basin (*e.g.*, dimensions, construction, inlets), depth to water, height of standing water, sediment thickness, sediment characteristics, debris, etc. Sample collection information, such as how the sample was collected and any problems that occurred during collection, visual sample observations, and any other unusual circumstances that may affect the analytical results should all be noted. Any field measurements, such as pH, temperature, or observations such as odor or sheen should also be recorded on the field data sheets.

Standard sample collection methods and chain-of-custody procedures require basic information such as date and time, sample collector, and number of sample bottles filled and parameters to be analyzed. Consult with the analytical laboratory for chain-of-custody forms.

D.4.5 Data Quality Assurance and Control

The catch basin sediment-sampling plan should include or reference a site-specific data quality assurance plan that is developed in accordance with DEQ and EPA guidance documents.

D.5 Storm Water Sampling Design

Successful storm water monitoring presents a variety of challenges. Rainfall can be intermittent and sampling locations may be inadequate or difficult to identify or access. Planning efforts that address the variability of storm water runoff, as well as the technical considerations of sample collection, are critical to the acquisition of representative data. In 1992, EPA published its *NPDES Storm Water Sampling Guidance Document* (EPA, 1992), which provides comprehensive information on storm water sampling. The Washington State Department of Ecology (WDOE) subsequently published a more user-friendly guidance document for industrial facilities subject to NPDES monitoring requirements entitled *How To Do Stormwater Sampling* (WDOE, 2005, see Attachment D). The WDOE document describes the necessary steps and procedures to collect storm water samples from industrial facilities. Both the EPA and WDOE guidance documents may be helpful in designing and conducting storm water sampling.

A thorough storm water quality characterization will entail “first flush” grab sampling as well as flow monitoring and composite sampling throughout the duration of the storm event to establish pollutant loading. For purposes of Portland Harbor screening, “first flush” is defined as being within the first 30 minutes of storm water discharge. For the purposes of Portland Harbor storm water screening evaluations, grab samples will be utilized to ascertain whether or not storm water poses or may pose a threat to Willamette River sediment or water quality. A more detailed characterization may be required if source control measures do not adequately address pollutant discharges identified with the grab sample screening.

D.5.1 Sampling Locations

Storm water sampling locations that represent all points of potential contaminant discharge should be selected. Refer to the drainage areas identified in the SWPCP, if available, and the information developed for the site storm water map (See Subection 2.2) to aid in the selection process for catch basin sediment sampling sites. Facilities operating under NPDES permits will have established points of compliance[9]. These locations represent storm water discharge from areas regulated by the NPDES permits – additional sampling locations may be needed to evaluate discharges from other areas of known or suspected contamination.

Sampling locations may be at outfalls, manholes, catch basins, drainage ditches, detention ponds, and areas with sheet flow. Each type presents unique challenges to sample collection, but selecting sampling locations that represent the storm water discharge from all areas of concern at the site is a critical piece of the storm water screening evaluation. Ideally, sampling locations should not include storm water flows from other facilities or offsite areas.

D.5.2 Storm Water Sampling Frequency

It is recommended that at least four separate storm events per year be sampled for screening purposes. Because storm water quality varies considerably with rainfall intensity and duration, two of the four sampling events should be representative of "first flush" conditions (*i.e.*, within the first 30 minutes of storm water discharge). For the remaining two events, samples should be collected within the first three hours of storm water discharge, to the extent practicable.

D.5.3 Storm Event Criteria and Selection

Adhering to target storm event criteria will help to ensure that storm water runoff will be adequate for sample collection, will be representative of storm water runoff, and will be consistent with other sites undergoing storm water screening evaluations. If storm water samples are intended to satisfy NPDES permit monitoring requirements, more restrictive event criteria and specific requirements for samples taken during storm events that fall short of expected volume or duration may apply.

[9] NPDES 1200-Z permittees have selected "representative" outfalls for storm water sampling, based on the areas where industrial activities take place and industrial materials are stored and handled. These selected outfalls are identified in a facilities storm water plan approved by DEQ's Water Quality Program

Storm event criteria for the screening evaluation are as follows:

- Antecedent dry period of at least 24 hours (as defined by <0.1" over the previous 24 hours);
- Minimum predicted rainfall volume of >0.2" per event; and
- Expected duration of storm event of at least 3 hours.

The City of Portland owns and operates a series of rain gauges around the City. Several of these rain gauges are located within the Portland Harbor ISA. These can be utilized to evaluate the antecedent dry period criteria, as well as post-storm event rainfall distribution and totals. Rain gauges located in or near the Portland Harbor ISA are listed below:

River Bank	***Gauge No.***	***Gauge Name***	***Gauge Address***
West	*121*	*Yeon*	*3395 NW Yeon St.*
East	*122*	*Swan Island*	*2600 N. Going St.*
East	*160*	*WPCL*	*6543 N. Burlington Ave.*
East	*167*	*Terminal 4 NE*	*11040 N. Lombard St.*
East	*193*	*Astor Elementary School*	*5601 N. Yale St.*

The United States Geological Service provides online access to the City rain gauges at *http://or.water.usgs.gov/non-usgs/bes/raingage_info/clickmap.html*. Rain gauge data is updated hourly.

Weather forecast information can be obtained from the National Weather Service web site at *http://www.wrh.noaa.gov/pqr/* or by contacting the National Weather Service by phone. Web site information includes rainfall observations and forecasts, both of which are essential to storm event targeting. Refer to the WDOE guide in Attachment D for additional tips on storm event selection.

D.5.4 Storm Water Sampling Methods

There are two types of storm water samples: grab samples and composite samples. Grab samples are typically collected during a short period of time and characterize the nature of storm water discharge at that particular point in the storm event. Some laboratory analyses, such as oil and grease, require grab samples directly into sample bottles to ensure that the sample is not compromised during material transfer.

Storm water composite samples are comprised of a number of discrete individual samples of specific volumes taken at specific intervals. Intervals can be time-weighted or flow-weighted, and samples can be collected and composited manually or with automatic sampling equipment. Composite samples typically characterize storm water quality during a longer period of runoff. Flow-weighted composite samples are utilized to assess contaminant-loading and to evaluate the variable nature of storm water discharges.

Grab samples, collected by upland facilities during both the initial runoff ("first flush grab samples") and at a point within the first three hours of runoff ("periodic grab samples"), will provide the screening level data on which decisions for further storm water characterization or source control measures can be made. For the purposes of Portland Harbor storm water screening evaluations, composite sampling is not required initially. If site-specific storm water data indicates the need for a composite sampling, then composite samples may be required.

Proper sample collection methods and techniques are needed to collect representative samples. Sampling protocols should address bottle handling, equipment preparation, collection methods, and sample storage. Basic principles are detailed below. Refer to the WDOE guidance document (see Attachment D) or EPA's 1992 guidance document for more detailed information on sample types and collection methods.

Because COIs are often present at low concentrations in storm water, alternative sampling or analytical methods, may be needed to obtain meaningful detection limits (see the discussion on practical quantification limits in the JSCS).

D.5.4.1 First Flush Grab Samples

Grab sample collection, for two of the four storm events recommended to be sampled each year, should be timed to be within the first 30 minutes of storm water runoff, to extent practicable. This period, termed "first flush," often represents a worst-case scenario of storm water quality for pollutants likely to be mobilized by storm water runoff. Sampling first flush runoff requires significant advance preparation to ensure that equipment and personnel are available at sampling locations at the proper time. Initial rainfall intensity can vary widely, resulting in delayed or immediate first flush conditions.

Other factors also influence the timing of first flush discharge. Each sample point represents a specific drainage area, and each drainage area may have different runoff characteristics depending on the type of surface area (pervious or impervious), slope, and size. In storm water monitoring, runoff coefficients are utilized to calculate the amount of rainfall expected to be discharged from an area rather than absorbed by underlying soil. A runoff coefficient of 1.0 would indicate that 100% of the rainfall volume within the drainage area will be discharged. A review of the storm water drainage areas identified on the facility storm water map will help to predict how first flush discharge could be expected to occur.

D.5.4.2 Periodic Grab Samples

Sample collection for the remaining two storm events recommended to be sampled each year should take place within the first three hours of storm water runoff. This will allow for a higher degree of flexibility and potential for opportunistic sampling. When selecting the timing of sampling, consideration should be given to seasonal or operational variations (*e.g.*, heavy production, truck use, product storage) at the facility to assure representative samples are collected. Mobilization could occur once the storm event is already underway. Separate storm events must be sampled for each of the four samples needed for the screening evaluation.

While the screening evaluation only requires one set of grab samples per storm event, collecting periodic grab samples at various times throughout the storm may provide useful information on pollutant discharge correlation with rainfall intensity, volume, or duration.

D.5.5 Field Documentation

Comprehensive field documentation should be made to aid in the interpretation of analytical results. At a minimum, field documentation should include a description of the weather – what time rainfall began and when runoff was first observed at the sampling location. Sample collection information, such as how the sample was collected and any problems that occurred during collection, visual sample observations, and any other unusual circumstances that may affect the analytical results should all be noted. Any field measurements, such as pH, temperature, or conductivity, should also be recorded on the field data sheets.

Standard sample collection methods and chain-of-custody procedures require basic information such as date and time, sample collector, and number of sample bottles filled and parameters to be analyzed. Consult with the analytical laboratory for chain-of-custody forms.

D.5.6 Data Quality Assurance and Control

The storm water sampling plan should include or reference a site-specific data quality assurance plan that is developed in accordance with DEQ and EPA guidance documents.

D.6 Screening Evaluation

The JSCS describes the source control decision process to help DEQ project managers determine if source control measures are required at Portland Harbor sites and, if so, the priority for source control implementation and type of source controls to be implemented. This decision is ultimately based on whether the contaminant discharge has a current or reasonably likely future adverse effect on water or sediment quality.

Storm water discharge and catch basin sediment data (or other storm water sediment data) should be screened against the SLVs presented in the JSCS to assess potential impacts to the Willamette River. As a first step, exceedances of storm water or catch basin SLVs may require implementation of readily implementable BMPs or additional investigation and evaluation. BMPs should be applied with the goal of preventing contaminants from entering the storm water system and of ensuring proper maintenance of that system to improve its effectiveness.

The source control screening process is an iterative process requiring the upland PRP or DEQ project team to update the site conceptual site model (CSM) at the completion of each major phase of the investigation. The primary purposes of source control screening include:

- Determining if site characterization is sufficient to support informed source control decisions;
- Determining if storm water sediment data is needed; and
- Prioritizing sites for further remedial action (or source control activities (*e.g.*, investigation, evaluation, cleanup).

If readily implementable BMPs are not effective in reducing storm water or storm water sediment concentrations to below applicable SLVs, a qualitative or quantitative weight-of-evidence evaluation should be performed by the responsible party to determine if more aggressive storm water investigation and/or source control, such as source removal, storm system improvements (*e.g.*, line cleaning, catch basin replacement), or storm water treatment are needed. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA, and its partners in accordance with the JSCS.

Data collected for evaluating the storm water pathway may also be used by DEQ to determine if a Storm Water Pollution Control Plan is needed at the facility.

D.7 Reporting

D.7.1 Catch Basin Sediment Sampling Event Summary

Following the collection of catch basin sediment data, a summary report should be developed that compiles the field documentation, analytical results, and background information. Background information should include documentation of precipitation totals preceding and during sample collection, as well as any field notes generated during the sampling event. This report, in addition to the considerations listed in Section 3.3, will be the basis for review to identify storm water sampling parameters, and should be submitted as soon as possible after the receipt of analytical results.

D.7.1.1 Analytical Results

Copies of original laboratory reports and chain-of-custody documentation should be submitted as part of the summary reports of catch basin sampling events. Laboratory results should be tabulated. The tables should clearly identify the sampling location(s), unit of measurement, compounds detected, laboratory detection limits, and SLVs. Detected compounds should be in bold text and compounds exceeding SLVs should be shaded for easy reference.

D.7.1.2 Catch Basin Sediment Screening Evaluation

A summary of the catch basin sediment screening results (see Section 6) should be presented. The report should include a discussion of compounds detected, compounds detected above SLVs, magnitude of SLV exceedance, and a list of any PBTs detected. While the absence of a certain contaminant may not alone warrant its exclusion from storm water monitoring, in the context of current and historic facility operations, it may provide information relevant to a weight of evidence determination to eliminate a contaminant from further consideration.

D.7.2 Storm Water Sampling Event Summaries

Following the storm water sampling event, rainfall and weather information should be documented along with the field data sheets. This information can be included in the quarterly progress report required under DEQ's Portland Harbor Voluntary Agreements or in brief summary reports developed for each of the storm water sampling events. The RI report should include the results of all storm water monitoring events, if the schedule allows.

D.7.2.1 Rain Gauge Data – Sample Event Criteria Evaluation

It is not uncommon for rainfall volume or distribution to fall short of expectations. Rainfall may have been intermittent when first flush grab samples were collected at different times for a given site. Hourly rain gauge data as well as rain gauge totals should be included in the summary report, as well as documentation of the antecedent dry period (minimum of 24 hours). The data should be evaluated to determine whether or not the target storm criteria (Subsection 5.3) were met. If runoff coefficients were generated for the drainage basins, the rainfall data can also be utilized to estimate the volume of storm water discharge during the course of the event.

If samples were collected from a storm event that did not meet the target storm criteria but are being submitted to comply with NPDES permit monitoring requirements, specific approval is required from DEQ to justify the protocol modification.

D.7.2.2 Analytical Results

Copies of original laboratory reports and chain-of-custody documentation should be submitted as part of the sampling event summary reports. Laboratory results should be tabulated. In addition, an electronic copy of the data should be provided to DEQ. The tables should clearly identify the sampling location(s), unit of measurement, compounds detected, laboratory detection limits, and SLVs. Compounds detected should be in bold text and compounds exceeding SLVs should be shaded for easy reference.

D.7.2.3 Storm Water Screening Evaluation

A summary of the storm water screening results (see Section 6) should be presented in the report. The report should include a discussion of compounds detected, compounds detected above SLVs and/or NPDES industrial benchmarks, magnitude of the exceedance, and a list of any PBTs detected.

Analytical data should be evaluated in the context of the hydrologic conditions that preceded the storm event as well as in those that existed at the time of sample collection. Each storm event will present unique conditions. In some cases, difficulties with sample collection may lead to samples that are not representative of storm water discharge from a given basin or facility. In these and other cases, results may warrant a more comprehensive characterization of storm water discharges before the identification of source control measures.

D.8 References

D.8.1 Cited References

CH2M Hill, 2004. *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project*. Prepared for City of Portland Bureau of Environmental Services. March 19, 2004.

CH2M Hill/COP, 2005. *Standard Operating Procedures Draft 3.0. Guidance for Sampling of Catch Basin Solids.* Prepared by CH2M Hill for the City of Portland (City provided revisions). June, 2005. City of Portland, Bureau of Environmental Services.

DEQ/EPA, 2005. *Portland Harbor Joint Source Control Strategy*. Oregon Department of Environmental Quality Northwest Region Cleanup Program and United States Environmental Protection Agency – Region X. pending (Anticipated September 2005).

EPA, 1992. *NPDES Storm Water Sampling Guidance Document*. United States Environmental Protection Agency. Office of Water. EPA 833-8-92-001. July 1992.

LWG, 2004a. *Portland Harbor RI/FS - Programmatic Work Plan(Volumes 1 through 3).* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., Kennedy/Jenks Consultants, Anchor Environmental L.L.C., and Groundwater Solutions, Inc. Prepared for The Lower Willamette Group (LWG). Dated April 23, 2004.

WDOE, 2005. *How To Do Stormwater Sampling – A guide for industrial facilities*. Washington Department of Ecology. Publication #02-10-071. December 2002 (revised January 2005).

D.8.2 Additional References

COP, 2000a. *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area, (Eastshore).* July 2000. City of Portland, Bureau of Environmental Services.

COP, 2000b. *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area, (Westshore*). November 2000. City of Portland, Bureau of Environmental Services.

DEQ, 1998. *DEQ Storm Water Management Guidelines.* Oregon Department of Environmental Quality Water Quality Program. February 1998.

DEQ, 2004. *Water Quality Criteria Summary.* Table 20. Oregon Administrative Rules, Chapter 340, Division 041 - Department of Environmental Quality

DEQ, 2005. *Water Quality Criteria Summary Tables 33A, 33B, and 33C.* AWQC based on the acute and chronic freshwater aquatic life criteria in Table 33A and C, which is an update of OAR 34-41 Table 20. The Environmental Quality Commission adopted Table 33A on May 20, 2004 to become effective February 15, 2005. However, EPA has not yet (as of June 2005) approved the criteria for federal Clean Water Act purposes. Table 20 should be used for federal Clean Water Act purposes (except for Section 303(d) listing which should only use Table 20 until these criteria receive EPA approval).

EPA, 1997. *Ambient Water Quality Criteria Document for Tributyltin*, U.S. Environmental Protection Agency, 62 FR 42554, August 7, 1997.
-Freshwater Chronic Criteria.

EPA, 1998 *National Recommended Water Quality Criteria*. Federal Register 63 (Dec. 10): 68353-64.

EPA, 1999. *National Recommended Water Quality Criteria — Correction*. EPA 822-Z-99-001. Office of Water.

EPA, 2000. *Guidance Manual for Conditional Exclusion from Storm Water Permitting Based on "No Exposure" of Industrial Activities to Storm Water*. United States Environmental Protection Agency. Office of Water. EPA 833-B-00-001. June 2000.

EPA, 2003. *National Primary Drinking Water Standards*. EPA 816-F-02-013. Office of Water. June 2003. Available on EPA's website at: http://www.epa.gov/safewater/mcl.html#mcls

EPA, 2004. *Region 9 Preliminary Remediation Goals*, prepared by Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Team, San Francisco, California. Revision Date: 12/28/04

EPA, 2000. *Guidance Manual for Conditional Exclusion from Storm Water Permitting Based on "No Exposure" of Industrial Activities to Storm Water*. United States Environmental Protection Agency. Office of Water. EPA 833-B-00-001. June 2000.

LWG, 2004c. *Portland Harbor RI/FS – Round 2 – Field Sampling Plan – Sediment Sampling and Benthic Toxicity Testing.* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., and Anchor Environmental L.L.C. Prepared for The Lower Willamette Group (LWG). Dated March 22, 2004.

NOAA, 2003. *HCD Stormwater Online Guidance – ESA Guidance for Analyzing Stormwater Effects*. NOAA Fisheries Service. Northwest Region. March 2003.

Attachment A

Catch Basin Fact Sheets

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Fact Sheet

Portland Harbor

Catch Basins

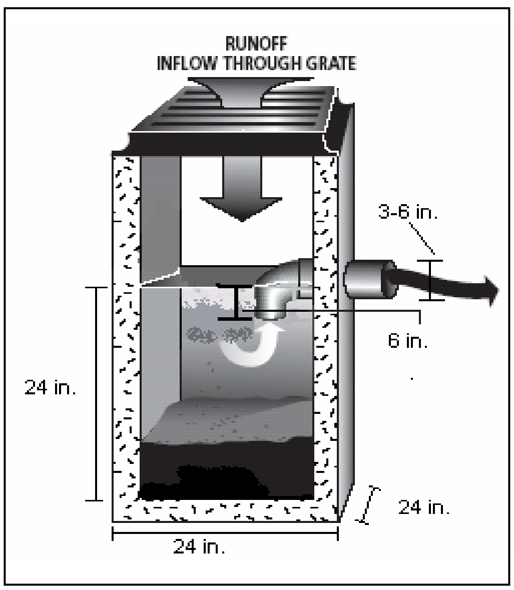
The purpose of this fact sheet is to provide basic information on catch basin design, effectiveness, and sediment sampling.

A catch basin is an inlet to a storm drain system that typically includes a grate where stormwater enters, and a sump to capture sediment, debris, and associated pollutants.

Catch basins are designed specifically for capturing and conveying stormwater. It is important to note, that although catch basins often have sumps for the collection of sediment, the actual design specifications and placement of catch basins are not based on expected sediment load.

Design

Trapped catch basins, commonly referred to as "Lynch-style" catch basins, are constructed of concrete, cast iron, or steel. According to the 1997 City of Portland *Uniform Plumbing Code* §1108.0 - .5, catch basins must adhere to the design specifications in the drawing below:



Standard "Lynch-style" catch basin

Typically, on private commercial/industrial sites, there is no standard for the placement of catch basins. Stormwater drain systems are often installed based on the best professional judgment and experience of the design engineer.

The estimated peak stormwater flow rate dictates the number of catch basins needed on a site. The percent impervious surface, slope, average rainfall, and rainfall intensity are all factors in calculating the peak flow rate.

Catch basins are designed to hold water below the ¼ bend outlet pipe, or "elbow pipe." The pipe is also referred to as a 90 degree invert. The standing water allows some larger sediments to settle out. Any oil or grease washed into the basin will float to the top of the water level, above the elbow pipe. The catch basin is only effective for oil and grease separation if the water level is maintained above the elbow pipe intake.

Effectiveness

There are several factors that contribute to the capture efficiency of catch basins. These include catch basin placement, catch basin design (e.g., sump size); maintenance frequency (e.g., sediment removal), flow rate, pollutant loading, and particle size.

The sump in a catch basin captures settleable solids under low flow conditions. According to information obtained from EPA, catch basins are typically best at removing particles greater than 0.04 inches (approx. 1mm in diameter). They are not designed to remove total suspended solids (TSS) or soluble pollutants.

There is limited data on the effectiveness of "Lynch style" standard catch basins to capture TSS. Several studies indicate TSS may be reduced by about 20% in some catch basins.

Resuspension and discharge of sediments previously collected in a catch basin is a potential problem during large storm events or "first flush" scenarios.

Catch basin efficiency can be improved by frequent maintenance, implementation of best management practices (BMPs) or with the use of catch basin inserts, as discussed below.

Maintenance: Maintaining catch basins is critical to their effectiveness. Catch basins should be cleaned when the amount of sediment is greater than 1/3 the distance between the bottom of the basin and the water line. It is recommended that catch basins draining industrial areas be cleaned once per month or more frequently if sediment accumulates above

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Department of Environmental Quality

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Cleanup and Lower Willamette Section
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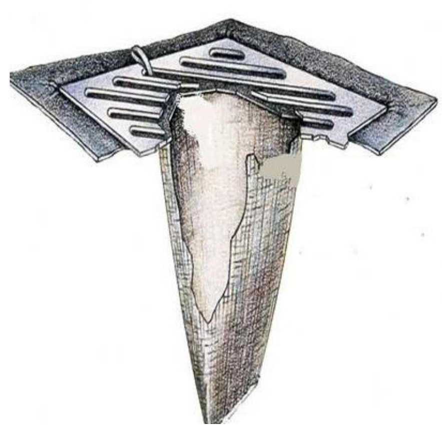
DEQ 05-NWR-006

the 1/3 threshold. A study of 60 catch basins draining industrial land in Alameda County, California showed that monthly cleaning of industrially used catch basins increased the total pounds of collected sediment from 30 lbs. when cleaned annually to 180 lbs. when cleaned monthly. For more information on catch basin maintenance, see the City of Portland's fact sheet titled, "Maintaining Catch Basins" at: http://www.portlandonline.com/shared/cfm/image.cfm?id=71693

Best Management Practices: Implementation of BMPs, such as frequent sweeping, covered material storage areas, etc. will help reduce potential sediment and pollutant loading. BMPs recommended by DEQ are available on our website at: www.deq.state.or.us/nwr/Industrial%20BMPs.pdf

Catch Basin Inserts: Sediment and pollutant loading can be reduced using catch basin inserts. Many different styles of catch basin inserts are available. Some provide oil absorbent strips while others just provide sediment capture (e.g., filtering). Generally, the capacity of inserts is much less than that of the actual basin, which means more frequent maintenance. The advantage to using inserts is that a greater amount of sediment (settleable solids and TSS) is expected to be captured. In addition, the maintenance is much simpler since most inserts can be removed and disposed of by hand. It is recommended that inserts without overflow slots be used to provide for maximum efficiency. The method of sediment disposal depends on whether the captured sediment is contaminated. See DEQ's fact sheet "How to Determine if Your Waste is Hazardous" http://www.deq.state.or.us/wmc/hw/factsheets/HowDetermineHazWaste.pdf for more information.



Catch Basin Insert

Stormwater Management Manual

All projects within the City of Portland, including industrial sites, developing or redeveloping over 500 square feet of impervious surface, or existing properties proposing new stormwater discharges off site are subject to the requirements of the Bureau of Environmental Services (BES) Stormwater Management Manual (SWMM). The SWMM requires 70 percent removal of TSS for 90 percent of the average annual runoff.

A site may achieve 70 percent removal of TSS by many different means. Please refer to the 2004 BES SWMM for more details. http://www.portlandonline.com/bes/index.cfm?c=35122

Catch basin sediment sampling

Catch basin sediment sampling is typically required at Portland Harbor upland sites to help characterize and evaluate the stormwater pathway and to determine if source control measures are required to prevent contaminants from impacting the river and its sediments. Catch basin sampling is required to provide a time-integrated sample of contaminants that may be or may have been transported to the river. Catch basin sample analyses should be based on a comprehensive review of potential contaminant sources, available in-water sediment data, and other available data. Sampling should be conducted in accordance with a DEQ approved work plan and BES sampling guidelines.

Considerations when assessing catch basins:

- The presence and size of the sump;
- The outlet location and type;
- The pollutant loading potential of the area drained;
- The use of catch basin inserts and frequency of replacement;
- The schedule of catch basin maintenance;
- Other BMPs the facility has implemented; and
- Available stormwater monitoring data and catch basin sediment data.

Alternative formats

Alternative formats (Braille, large type) of this document can be made available. Contact DEQ's Office of Communications & Outreach, Portland, at (503) 229-5317, or toll-free in Oregon at 1-800-452-4011.

Fact Sheet: Information for Property Owners

Portland Harbor

Cleaning Private Stormwater Conveyance Lines

Portland Harbor and Lower Willamette Sections Voluntary Cleanup Program Northwest Region

2020 SW 4th Avenue
Portland, OR 97202
Phone: (503) 229-6361
(800) 452-4011
Fax: (503) 229-6899
Contact: Jordan Palmeri
www.deq.state.or.us

Introduction

Property owners of upland sites in DEQ's Cleanup Program within the Portland Harbor Superfund Site are required to investigate stormwater as a potential migration pathway for contaminants to the Willamette River. As property owners of these sites evaluate the stormwater pathway, they may choose to clean their stormwater system conveyance lines of any solids or debris that may have accumulated in them from onsite erosion, operational processes, or spills.

The purpose of this fact sheet is to provide the following information:

- why a private stormwater system is considered part of an upland "facility";
- the importance of characterizing the solids in or being cleaned from the stormwater lines; and
- the necessity to notify the City of Portland of stormwater system cleaning activities if certain conditions apply.

For facilities under a cleanup agreement with DEQ, DEQ considers the private stormwater system to be a part of the upland "facility" and subject to DEQ oversight and cleanup rules. Oregon Revised Statute (ORS) 465.200 defines a facility as "*… any…pipe or pipeline including any pipe into a sewer or publicly owned treatment works…ditch…or any site where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located and where a release has occurred or where there is a threat of a release….*" Therefore, DEQ requires that any sampling or cleaning of the stormwater system be performed under an approved DEQ Cleanup Program work plan.

Characterization of inline solids

Characterizing solids that have accumulated in stormwater lines may be necessary to define the nature and extent of hazardous substances at an upland facility. Property owners should make an effort to delineate stormwater drainage basins at their facility, and to strategically use this information to develop the line cleaning work plan. Inline data may be used to help focus on drainage basins with potential contaminant sources and to assess potential source control measures. Based on this characterization, Best Management Practices (BMPs) may be implemented to prevent future movement of contaminants through the stormwater system or potential recontamination of Willamette River sediments. When feasible, sampling the undisturbed solids (i.e., sediment) before cleaning contributes to the investigation and source control evaluation of the upland facility. This data helps characterize the extent and migration of contaminants via the stormwater pathway.

Inline solids removed from the collection system may require dewatering and additional testing to ensure appropriate disposal in accordance with applicable DEQ Solid and Hazardous Waste regulations.

Wastewater generated from line cleaning activities may not be discharged to the private or municipal stormwater conveyance system. Wastewater disposal options include offsite disposal by a permitted private waste management company capable of appropriate treatment and disposal, or discharge to the City of Portland's sanitary sewer system through a batch discharge process (see below for details). The line cleaning work plan should include disposal plans for both inline solids and wastewater generated by the cleaning process.

Notify the City of Portland

Notify the City of Portland, Bureau of Environmental Services (BES) before you begin stormwater line cleanouts if any of the following three conditions apply to your facility:

- *Lines are connected to a municipal stormwater conveyance system.*

BES has requested notification of proposed cleaning operations in order to ensure worker safety for City and contract personnel and to verify that prohibited discharges of solids or wastewater are not made to the municipal conveyance system. A permit will be required if cleaning or sampling activities necessitate access to the City system. All stormwater line cleaning activities that connect to the City's conveyance system, and affiliated proposed access to City stormwater lines should be coordinated with the

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By: Jordan Palmeri
DEQ 05-NWR-111

BES Portland Harbor Program, at (503) 823-2296.

- *Facility operations are covered by an active NPDES stormwater permit.*

For facilities with active NPDES stormwater permits, notification will also allow for technical assistance and oversight from BES Permit Managers. BES administers stormwater NPDES permits for facilities within the City of Portland through a Memorandum of Understanding with DEQ. Contact the BES Industrial Stormwater Program at (503) 823-5320.

- *Line cleaning wastewater will be discharged to the sanitary sewer.*

Wastewater collected from these cleaning operations may not be discharged to the stormwater conveyance system even if the facility has an NPDES permit. It may be discharged to the City sanitary sewer system through a batch discharge process if it meets the wastewater discharge limitations established in City Code Chapter 17.34 "Industrial Wastewater Discharges" and is approved by the BES Industrial Source Control Division. Prohibited discharges include discharges of chemicals in toxic concentrations, of visible floating solids, and discharges that may cause a hazard to the City's system, personnel, or receiving waters. Coordinate batch discharge requests with the BES Industrial Projects Section at (503) 823-5320. Information and forms can also be found at the following link: http://www.portlandonline.com/index.cfm?c=37681#batch. Facilities with BES Industrial Wastewater Discharge Permits should consult directly with their BES Permit Managers.

Further Information

For more information on evaluating the stormwater pathway at upland facilities within Portland Harbor, please refer to the "Framework for Portland Harbor Storm Water Screening Evaluations", which is located in Appendix E of the Portland Harbor Joint Source Control Strategy at the following website: http://www.deq.state.or.us/nwr/PortlandHarbor/JSCS.htm. Information on catch basin sampling can also be found in this appendix. Additionally, a fact sheet on catch basin design, effectiveness, and sampling can be found at the following website: http://www.deq.state.or.us/nwr/PortlandHarbor/phfactsheets.htm.

Alternative formats

Alternative formats (large type) of this document can be made available. Contact DEQ's Office of Communications & Outreach, Portland, at (503) 229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696.

17 Maintaining Catch Basins

A catch basin is an inlet to a storm drain system that typically includes a grate where stormwater enters the catch basin, and a basin to capture sediment, debris, and associated pollutants. The purpose of the basin is to help prevent the downstream pipes from becoming clogged and to reduce the amount of sediment and debris being discharged into our rivers and streams. Many catch basins are installed with a downturned elbow or tee to trap floatable material. Storm drain inlets that do not contain basins or outlet traps are not effective in reducing pollutants in stormwater.

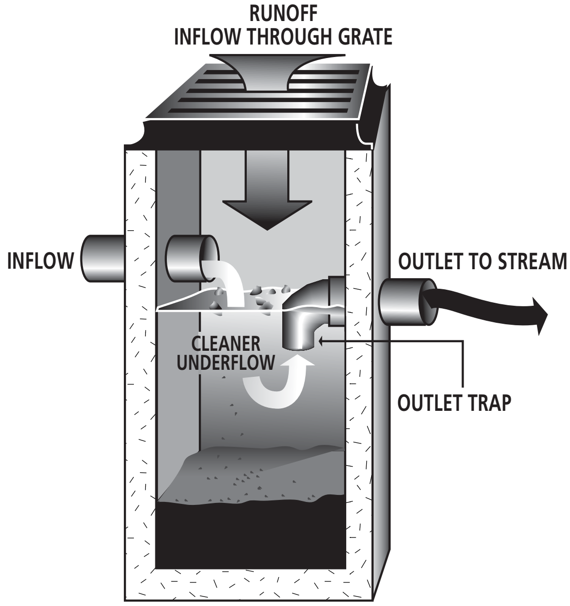
Catch basins must be cleaned periodically to maintain their ability to trap sediment and provide drainage for stormwater. The removal of sediment, decaying debris, and associated pollutants from catch basins has aesthetic and water quality benefits. The benefits include reducing foul odors, solids, and other pollutants that reach receiving waters.

Grates:

- Remove leaves and trash so the grate doesn't clog.
- Stencil the message "Dump No Waste, Drains to Stream" next to your grates. Call the City's Industrial Stormwater Program at 503-823-5320 to borrow the materials you need.

Catch Basin:

- The more frequently a catch basin is cleaned, the more pollutants it removes. The U.S. Environmental Protection Agency (EPA) recommends cleaning if the depth of solids reaches one-third the depth from the basin bottom to the invert of the lowest pipe into or out of the basin.
- Clean the catch basin. You can hire a contractor or you can do it yourself by lifting the grate and using a bucket (to remove water) and a shovel.



- Dispose of the water in a sanitary sewer through a shop drain or sink. Otherwise, use a toilet or other appropriate drain. Let the removed solids dry out, then properly dispose of them. When deciding how to dispose of the sediment, you need to consider the types of activities and pollutants on site. Catch basins in areas used for chemical or hazardous waste storage, material handling or equipment maintenance may collect the chemicals used in these activities from spills or via stormwater runoff. Solids removed from catch basins at commercial or industrial sites are usually not considered hazardous waste.

  However, as the "generator" of this waste, you are responsible for making that decision and deciding how to properly manage the solids. If you need assistance deciding whether the solids should be managed as a hazardous waste, contact the Oregon Department of Environmental Quality at 503-229-5263. Make sure the removed solids don't wash back into your catch basin, and don't dispose of it on your or someone else's property.

continued on back

Be sure to follow safety precautions:

- The grate may be heavy.
- Don't leave an open catch basin unattended.
- Never enter a catch basin or other drainage structure unless you are properly trained.
- Ensure proper traffic safety is in place.

Tips:

- Sweep your lot regularly to reduce the need for catch basin cleaning.
- Consider installing and maintaining catch basin inserts or an oil-absorbent pillow.
- Repair or replace damaged outlet traps.
- Install an outlet trap if there isn't one already. They're inexpensive and make it easier and cheaper to remove any floatable pollutants that spill into your catch basin.
- Make sure your chemical and waste storage practices aren't exposed to rainfall and stormwater runoff.
- Don't wash vehicles or equipment to the storm sewer system.

For additional Best Management Practices to minimize pollution from other site activities call 503-823-5320.

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

Dan Saltzman, Commissioner   Dean Marriott, Director

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Attachment B

Potential PCB Source Fact Sheet

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Fact Sheet: Sources of Polychlorinated Biphenyls

Purpose

This fact sheet is intended to help Oregon Department of Environmental Quality (DEQ) project managers and City of Portland stormwater inspectors understand the types of industries, processes, and products that might be potential sources of polychlorinated biphenyls (PCBs). There are a variety of potential PCB sources in addition to more commonly recognized sources such as electrical transformer and capacitor oils and fluorescent light ballasts.

Background

PCBs are mixtures of synthetic organic chemicals that were commonly used for various applications from approximately 1929 until 1979 when the U.S. banned PCB manufacturing, processing, distribution, and use (EIP Associates, 1997). The U.S. was responsible for approximately half of the world's production of PCBs and imported approximately 50% of the remainder produced by other countries (minus exports) (EIP Associates, 1997; UNEP Chemicals, 1999). PCBs were produced and marketed in the U.S. under the trade names of Aroclor (produced by Monsanto Chemical Company) and Pyranol (produced by General Electric) (Nagpal, 1992). Because of health concerns, in 1971 Monsanto voluntarily restricted manufacturing of PCBs to use only in closed systems. Monsanto discontinued manufacture of PCBs in 1977, though PCBs continued to be imported into the U.S. until 1979 when the U.S. ban took effect (EIP Associates, 1997; ATSDR, 2000).

There are no natural sources of PCBs. Although their current commercial use is restricted in the U.S., they continue to be a common environmental contaminant because they are extremely stable.

Regulatory Framework

PCBs were regulated under a series of EPA actions culminating with a ban in 1979 on manufacturing, processing, distribution, and use of PCBs under the Toxic Substances Control Act (TSCA). Items such as transformers and hydraulic fluids were identified as high-risk sources and were targeted for accelerated phase-out. EPA anticipated that other lower-risk sources would eventually be removed from circulation as various products reached the end of their useful lives.

Certain current uses of PCBs are authorized under 40 CFR Part 761 and are summarized in Table 1:

TABLE 1

Current Authorized Uses of PCBs

Use	Comments
Transformers	Authorized use at any concentration though restrictions and regulatory requirements increase with higher PCB concentration thresholds.
Railroad Transformers	Transformers used in locomotives and self-propelled railcars. Authorized use at < 1,000 ppm; < 50 ppm if transformer coil is removed at any time.
Heat transfer systems, hydraulic systems, mining equipment	Authorized use at < 50 ppm
Natural gas pipelines	Authorized at < 50 ppm, or at > 50 ppm with additional requirements. PCBs may be present in natural gas compressors, scrubbers, filters, and in condensate.
Research & Development	Authorized primarily for purposes relating to environmental analysis, management, and disposal of PCBs. R&D for PCB products is prohibited.
Scientific Instruments	Examples include oscillatory flow birefringence & viscoelasticity instruments for the study of the physical properties of polymers, microscopy mounting fluids, microscopy immersion oil, and optical liquids.
Carbonless copy paper	Use of existing carbonless copy paper is permitted; manufacturing of new carbonless copy paper is not authorized.
Electromagnets, switches, voltage regulators, circuit breakers, reclosers, cable	No restrictions on existing use; restrictions on PCB concentrations if serviced and oil is removed or replaced.
Porous surfaces	EPA considers building materials, such as concrete, porous with respect to PCB leaks and spills. Porous building materials may be left in place following spills provided various conditions are met. Older industrial machinery often was designed to slowly leak (PCB-containing) hydraulic oil as a lubricant.
Source: EPA (2002)	

Under 40 CFR Part 761, recycled PCBs are defined as "those PCBs which appear in the processing of paper products or asphalt roofing materials from PCB-contaminated raw materials". Recycled PCBs are subject to the following restrictions:

- No detectable concentrations of PCBs are permitted in asphalt roofing materials that leave the manufacturing site; and
- Manufactured and imported paper products must have an annual average of less than 25 ppm PCBs with a maximum of 50 ppm.

Some manufacturing processes may inadvertently generate PCBs. These typically include chemical processes that involve hydrocarbons, chlorine, and heat. Typical processes include production of chlorinated solvents, paints, printing inks, agricultural chemicals, plastics, and detergent bars. These processes may be defined as "excluded manufacturing processes" under 40 CFR Part 761 if the following conditions are met:

- Manufactured or imported products must contain < 25 ppm PCBs;
- Manufactured or imported detergent bars must contain < 5 ppm PCBs;
- PCB concentrations must be less than 10 ppm at the point which PCBs are released to ambient air;
- "…PCBs added to water discharged from a manufacturing site must be less than 100 micrograms per resolvable gas chromatographic peak per liter of water discharged"; and
- Disposal of process wastes with PCB concentrations > 50 ppm must be conducted in accordance with 40 CFR Part 761 Subpart D.

Sources of PCBs

In the U.S., the most commonly used Aroclors were: 1221, 1232, 1242, 1248, 1254, and 1260 (DEQ, 1997). These and other Aroclors were used in a variety of materials to enhance insulative properties, improve physical and chemical resistance, and act as plasticizers, coolants, and lubricants. Additional information about specific Aroclors is included in Table A-1 (see Attachment 1).

Approximate usage of PCBs in the US is summarized as follows (EIP Associates, 1997):

Closed system and heat transfer fluids (transformers, capacitors, fluorescent light ballasts, etc.): 60%

Plasticizers: 25%

Hydraulic fluids and lubricants: 10%

Miscellaneous uses: 5%

As shown in Table 2, PCBs were commonly used in a number of electrical, heat transfer, and hydraulic applications as well as a range of other applications.

TABLE 2

PCB Uses

Primary Applications	
Dielectric fluids and transformers	Used as insulating material, coolant, and for fire-resistant properties. Potential sources would be facilities which used, stored, and serviced electrical equipment and which used significant amounts of electricity. These facilities could include, but are not limited to: Electrical transmission and distribution facilities; electrical equipment maintenance facilities and salvage yards; rail yards; and manufacturing facilities (sawmills, pulp and paper mills, chemical manufacturing, shipyards, primary and secondary metals smelting and refining, etc.)
Capacitors	Present in industrial facilities, industrial machinery both fixed and mobile, and consumer products. Includes larger power-factor correction capacitors associated with transformers, manufacturing facilities, and commercial buildings (usually near high power-usage equipment such as computer rooms and heating and cooling units); and smaller electric motor-start capacitors used in industrial

	equipment and appliances such as hair dryers, air conditioners, refrigerators, power tools, and submersible well pumps. Also includes capacitors used in appliances and electronics such as televisions and microwave ovens.
Fluorescent light ballasts	PCB-containing capacitors were used in fluorescent light ballasts. PCB-containing asphaltic resin (potting material) was also utilized as insulating material for some ballasts.
Electromagnets	Oil-cooled electromagnets are constructed with coils immersed in transformer oil to prevent over-heating and shorting. Used in cranes for picking up metal and for metal separation in recycling operations (metal scrap yards, tire shredding, concrete crushing, slag operations, etc.).
Miscellaneous electrical equipment	Switches, voltage regulators, circuit breakers, reclosers, rectifiers, and some oil-cooled electric motors.
Heat transfer systems	Where oil is circulated through a non-contact system as a heat transfer medium for heating, cooling, and maintaining uniform temperature throughout a system or manufacturing process. Wide variety of applications in manufacturing industries including high-tech, asphalt, pulp and paper, metal products such as steel tubing and die casting, adhesives, chemicals, food processing, paint & coatings, textiles, etc.
Hydraulic fluids	Any application of hydraulic oil such as industrial equipment and machinery, commercial equipment, automotive brake fluid, etc.
Plasticizers	Used in polyvinyl chloride plastic, neoprene, chlorinated rubbers, laminating adhesives, sealants and caulking, joint compounds (concrete), etc.
Lubricants	Cutting oils, compressors, electrical equipment, oil-impregnated gaskets and filters; also currently present in low concentrations in recycled oil. Also used in vacuum pumps at high tech and electronics manufacturing facilities, research labs, and wastewater treatment plants.
Other applications of PCBs	
Dust control (dedusting agents)	Present in dust control formulations, and used oil historically used for dust suppression.
Pesticides	As an extender to extend the life of pesticides.
Fire retardants	Coatings on ceiling tiles, and textiles including ironing boards and yarn.
Paints, coatings	As plasticizers in paint, corrosion resistant paints for various applications including military/navy ships, corrosion resistant epoxy resins on metal surfaces, film casting solutions for electrical coatings, varnish, lacquers, and waterproofing coatings for various applications.
Carbonless copy paper	Used as an ink pigment carrier (microencapsulation of dye); when the top sheet was pressed down, ink and PCB oil were transferred to the copy.
Printing inks	Ink for newsprint and as a dye carrier; also used as a solvent for deinking newsprint for recycling.
Investment casting waxes	Used as wax extenders.
Wood treatment	May be present as an impurity in pentachlorophenol (Warrington, 1996).
Sources: ATSDR (2000), DEQ (1997), EIP Associates (1997), UNEP Chemicals (1999)	

Due to the long service life of many PCB-containing items and the use of PCBs in some durable, relatively inert products, PCB-containing materials will continue to be disposed of and processed in waste and recycling operations. Waste products and recycling operations that may process significant quantities of PCB-containing materials are described in Table 3:

TABLE 3

PCB Sources In Waste Materials And Recycling Operations

Material or Operation	Comments
Scrap metal recycling	Transformer shell salvaging; heat transfer and hydraulic equipment; and fluff (shredder waste from cars and appliances including upholstery, padding and insulation). Also present in non-ferrous metal salvaging as parts from PCB-containing electrical equipment, and oil & grease insulated electrical cable.
Auto salvage yards, auto crushing	Hydraulic fluid, brake fluid, recycled oil, capacitors, and oil-filled electrical equipment such as some ignition coils.
Repair activities	Shipyards (electrical equipment, hydraulic oil, paint, etc.), locomotive repair, heavy equipment repair facilities, auto repair, repair of manufacturing equipment, etc.
Used oil	May be present in used oil from various sources including auto salvage yards, automotive and heavy equipment repair shops, hydraulic equipment repair, industrial machinery repair, etc. Because some PCBs have been mixed with used oil, some recycled oils currently in circulation may contain PCBs at concentrations generally < 50 ppm. PCBs may also be present where used oil has been used for dust suppression/road oiling, weed control, and energy recovery.
Recycled paper	Paper may contain PCBs where carbonless copy paper has been used in recycling. However, PCB concentrations have decreased over time as the volume of unrecycled carbonless copy paper is reduced. Recycled paper containing PCBs has historically been used for food packaging (CWC, 1997). PCB concentrations in food packaging are restricted to 10 ppm unless an impermeable barrier is present between the packaging and food product (FDA, 2003).
Effluent	PCBs may be in wastewaters from manufacturing facilities and equipment such as chemical and pesticide facilities, pulp and paper mills, cooling waters from vacuum pumps and electric power generation facilities where leaks have occurred, and condensate from vacuum pumps and natural gas pipelines. Significant cleanup activities have been performed at natural gas pipeline compressor stations from discharges of condensate to ground and storm drainage systems (DOJ, 2002).
Asphalt roofing materials, tar paper, and roofing felt	Anticipated at generally very low concentrations where used oil containing PCBs has been used in asphalt mix.
Building demolition	Electrical equipment, joint caulking, oil & grease insulated cable, surface coatings as flame retardant and waterproofing.
Dredge spoils	From areas where contaminated sediments are present.
Landfills	Municipal and industrial solid waste; virtually all potential sources could be present, including waste materials and soils from remediation sites.
Wastewater treatment plant sludge	Derived from atmospheric deposition and stormwater, water supply systems, leaks and spills, leaching from coatings and plastics containing PCBs, PCBs in food and human waste.

Sources: EIP Associates (1997), EPA (2002), UNEP Chemicals (1999)

Releases of PCBs

Prior to the regulation of PCBs under the Toxic Substances Control Act (TSCA) in 1976, PCBs were released (both accidentally and intentionally) into the atmosphere, water, and land through sewers, smokestacks, stormwater runoff, spills, and direct application to the environment (for example, to reduce dust emissions and to extend the life of some agricultural pesticide formulations) (Flynn, 1997). Large volumes of PCBs have been introduced to the environment through the burning of PCB-containing products, vaporization from PCB-containing coatings and materials, releases into sewers and streams, improper disposal of PCB-containing equipment in non-secure landfill sites and municipal disposal facilities, and by other routes (such as ocean dumping) (ATSDR, 2001).

Based on the current regulation of PCBs, the current primary "new" sources of PCB contamination are limited to outdated or illegal landfills and scrap yards and leaks or explosions of electrical equipment and other equipment (such as locomotive transformers) that may still contain PCBs (ATSDR, 2001). Other sources are facilities or sites that were previously contaminated with PCBs (for example, contaminated sediments). From contaminated sites, PCBs are emitted and re-deposited to the environment via volatilization from water and soil, wet and dry depositions, and revolatilization (HSDB, 2003). These processes are discussed in further detail in Attachment 2.

Attachment 1 – Common Uses of Aroclors

Common uses of specific Aroclors are shown in Table A-1.

TABLE A-1
Common Uses of Aroclors

Aroclor Type	Use and Comments
A-1016	Capacitors
A-1221	Capacitors Gas Transmission Turbines Rubber Polyvinyl acetate - Improved quick-track and fiber-tear properties Polystyrene – Plasticizer Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1232	Hydraulic fluid Rubber Adhesives Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1242	Transformers Heat transfer Hydraulic fluid Gas transmission turbines Rubbers Carbonless copy paper Wax extenders Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1248	Hydraulic fluids Vacuum pumps Rubbers Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1254	Transformers Capacitors

TABLE A-1	
Common Uses of Aroclors	
Aroclor Type	**Use and Comments**
	Hydraulic fluids Vacuum pumps Synthetic resins Wax extenders Dedusting agents Inks Cutting oils Pesticide extenders Sealants and caulking compounds Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance Styrene-butadiene co-polymers - Better chemical resistance Ethylene vinyl acetate – Pressure-sensitive adhesives Chlorinated rubber - Enhanced resistance, flame retardence, electrical insulation properties
A-1260	Transformers Hydraulic fluids Dedusting agents Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance Polyester resins - Stronger fiberglass; reinforced resins and economical fire retardants Varnish - Improved water and alkali resistance
A-1262	Synthetic resins Crepe rubber - Plasticizers in paints Nitrocellulose lacquers - Co-plasticizers Wax - Improved moisture and flame resistance
A-1268	Rubbers Synthetic resins Neoprene - Fire retardant; injection moldings Wax extenders
Sources: Nagpal (1992); ATSDR (2000).	

Attachment 2 – Fate and Transport of PCBs

The basic chemical structure of PCBs includes two benzene rings (known as the biphenyl) and between 1 and 10 chlorine atoms substituted on each of the benzene molecules. Figure 1 shows the basic structure of PCBs, where the numbers 2-6 and 2'-6' represent possible substitution locations for chlorine. There are a total of 209 individual PCB compounds (known as congeners) (Flynn, 1997). Typically, PCBs occur as mixtures of congeners (that is, Aroclors) (Bernhard and Petron , 2001). Aroclors are identified by number (such as 1254), with the last two digits representing the percent content of chlorine; higher Aroclor numbers reflect higher chlorine content (ATSDR, 2001).

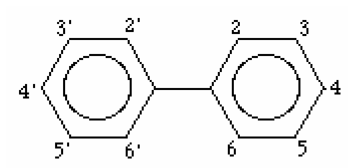

Figure 1. Basic PCB Structure

As discussed in the main text of this fact sheet, PCBs were emitted in large quantities before PCB manufacturing was banned in the U.S. Between 1930 and 1970, approximately 30,000 tons were released to air, 60,000 tons to fresh and coastal waters, and 300,000 tons to dumps and landfills (HSDB, 2003). Because of their extreme chemical and thermal stability, once they are introduced to the environment they remain there for years or even decades (ATSDR, 2000).

PCBs are nonpolar and therefore are only slightly soluble. This characteristic inhibits the transport of PCBs from soil to water (groundwater or surface water) and makes them bind strongly to soils. PCBs can be transported to surface water via entrainment of contaminated soil particles in surface water runoff. In water, a small portion of PCBs will dissolve, but the majority will bind to organic particles and bottom sediments (Nagpal, 1992). Although PCBs have a strong affinity for sediment, small amounts of PCBs are released from sediments to water over time (ATSDR, 2000). Once in the water, PCBs are also taken up by small organisms and fish. PCBs accumulate in the fatty tissue of these organisms.

PCBs have a relatively low vapor pressure. Despite their low volatility, PCBs do volatilize from both soil and water. This is a result of their widespread presence and extreme stability (DEQ, 1997). Once re-emitted, PCBs can be transported long distances in air, and then redeposited by settling or scavenging by precipitation. This cycling process continues indefinitely and is referred to as the grasshopper effect (EPA, 2001). It is estimated that there are currently 1,000 tons of PCBs cycling through the atmosphere over the U.S. (HSDB, 2003). Studies performed at Lake Michigan show that 80 percent of the PCBs entering the lake come from the air (Delta Institute, 2000). Additional evidence of the atmospheric deposition of PCBs is the presence of PCBs in sparsely populated areas of Canada and in Arctic polar bears (both far from point sources of PCB contamination) (Fiedler, 1997).

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Attachment C

Catch Basin Solid Sampling Standard Operating Procedures

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Standard Operating Procedures

Guidance for Sampling of Catch Basin Solids

Prepared for

City of Portland

July 2003

Prepared by

CH2MHILL

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Contents

Standard Operating Procedures—Guidance for Sampling of Catch Basin Solids

1.0 Purpose

This document describes Standard Operating Procedures (SOPs) for the collection of environmental solids samples from stormwater catch basins. It provides procedures to be used for assessing potential pathways of contamination from upland sources via stormwater conveyances to receiving waters and sediments. Sampling for environmental investigations requires different methods than those that may be used for determining waste profiles for catch basin solids disposal.

The procedures described here are intended to provide representative samples of catch basin contents. These procedures may be modified for other purposes, such as assessing characteristics of older or newer solids, or because of space or access limitations. All deviations from these SOPs should be noted in field logs and reports.

1.1 Background

Catch basins are typically designed to prevent debris, gravels, and soils from fouling storm drain lines, and generally remove larger particles (greater than approximately 1 millimeter in diameter). Unlike specially designed stormwater treatment vaults, catch basins are not intended to remove fine particles or soluble pollutants, and they may only marginally reduce concentrations of contaminants or suspended solids. Catch basin retention efficiencies for suspended solids may be highly variable as functions of basin design, stormwater flow rates, accumulated solids in the sump (a function of cleaning frequency), and solids particle characteristics. Finer particle fractions may be suspended in moving water and carried beyond the catch basin. Because these finer particles are often correlated with organic and inorganic contaminants, special care needs to be taken while collecting catch basin solids samples to ensure that the finer particle fraction is sampled.

2.0 Scope and Applicability

The methodologies discussed in these SOPs are intended to provide procedures for collecting representative environmental samples of solids in stormwater catch basins. These SOPs describe specific steps that can be used to ensure representative and comparable data.

Residual material in catch basins is inherently variable. Factors that can affect variability include the characteristics of catch basin structures, the sources of particles, water flow rates and stormwater quality, and the depth and pattern of accumulated solids. In addition, the characteristics of catch basin solids can vary from slurry-like to dry solids. Although variability may be unavoidable, standard methods of collecting and handling samples can improve data quality.

3.0 Equipment and Materials

The following equipment should be available for collecting solids samples from catch basins:

- Sampler (generally one type will be selected per catch basin)
  - Stainless steel scoop, trowel, or spoon
  - Bucket (hand) auger
  - Hand corer
  - Petite Ponar® dredge/Van Veen® dredge (0.025 square meter [m^2])
- Sampling Equipment List
  - Site Sampling and Analysis Plan and/or site files detailing sampling locations, sample collection, and site information
  - Large stainless steel bowl
  - Stainless steel mixing spoon
  - Latex gloves
  - Metal or wooden rod
  - Field data sheets or other documentation
  - Laboratory-supplied sample containers
  - Cooler and ice/chilled blue ice
  - Tape measure
  - Ziploc® bags
  - Field notebook
  - Permanent marking pens
  - Sample labels
  - Chain-of-custody seals
  - Personal Protective Equipment (PPE)

4.0 Procedures

4.1 Documentation

Regardless of the equipment to be used, the following general procedures apply:

- Confirm any active catch basin best management practices such as sweeping and cleaning, frequency of activity, etc., if known.
- Document design flow rates (base flow, storm flow) for catch basins, if known.
- Record weather conditions at the time of sampling and last known rainfall event(s).
- Record the location of the catch basin. Include potential solids or contaminant sources such as construction activities, erosion, equipment storage or use, waste or material storage, vehicles, exhaust vents, onsite processes, etc. Site features, distances, flow directions, and gradients should be noted or sketched on a site map.

- Record dimensions of catch basin. Diagram inlet/outlet pipes in the catch basin. The source of inlet flows and destination of outlet flows should be noted, if known.
- Note the presence of water, visible flows, signs of flooding, clogging, debris in or around the catch basin, blocked inlets/outlets, staining, etc.
- Note any apparent evidence of contamination in the catch basin, such as odor, sheen, discoloration, etc., of water or solids.
- Measure the depth of solids in the catch basin and the total depth of the catch basin or sump. Use a decontaminated metal rod or disposable wooden dowel to probe the total depth of the catch basin.
- When recovering samples, record visual observations of:
  - Color
  - Texture, estimates of particle size fractions (as soil classification)
  - Amount and type of debris (Note: any large debris observed in the sample, including sticks, leaves, beverage containers, miscellaneous pieces of plastic and metal, stones and gravel, etc., should be removed, but paint chips and small organic matter should be left in the sample)
- Prepare a diagram of sampling locations within the catch basin, noting any special features such as sumps, inlets and outlets, etc.
- Decontaminate all sampling equipment using documented procedures before and after any sampling activities. Record the decontamination procedures in the field notes.
- Record any deviations from the specified sampling procedures or any obstacles encountered.
- Complete a chain-of-custody form for all samples.

4.2 Selection of Sampling Method

Sampling equipment should be matched with the presence and depth of water, solids water content, and catch basin depth. Figure 1 presents a flow chart for determining the appropriate sampling device. Detailed descriptions of each sampling method are presented in Section 4.3.

4.2.1 Decontamination of Equipment

Non-disposable equipment that contacts solids samples should be thoroughly cleaned and decontaminated before each set of samples is collected. Decontamination should be done in accordance with City of Portland SOP 7.01a[1] or comparable standard. Decontamination solutions should be selected on the basis of the type of analysis being conducted on samples.

[1] Bureau of Environmental Services, Environmental Investigations Division, SOP No. 7.01a Draft or subsequent revisions, Decontamination of Sampling Equipment.

4.3 Sample Collection

This guidance for sampling catch basins is intended to assess individual catch basins as potential sources of past, present, or future conduits of contamination to Willamette River sediments. Sample collection should therefore incorporate material representative of the total depth and area unless specific alternative sampling objectives are otherwise noted and approved. In some cases, sample collection from discrete depths may be desired based on knowledge of catch basin maintenance and time since last cleaning, activities conducted within the drainage area, spills or releases, and related information.

Standing water in the catch basin, if present, may be pumped off to simplify sample collection. If this procedure is conducted, care must be taken to:

- Pump water from the surface only
- Leave a thin layer of water so that fine materials in the solids are not disturbed
- Pump water slowly so that fine materials are not disturbed
- Dispose of pumped water in the sanitary sewer (pumped water may not be released into the storm system)
- Document all steps taken, the depth and volume of water removed, the point of water disposal, water remaining before sampling, and other relevant factors

4.3.1 Sampling Firm Solids in Catch Basins Without Standing Water

Firm solids above the water line are most easily collected using simple soil sampling tools (that is, stainless steel spoon or trowel, or bucket auger). When sampling with a spoon or auger, solids may be moist or wet but should retain their form and structure when handled. (Note: If the sample has a high water content [water drips from solids], another sampling method should be considered to minimize the loss of fine particles in liquid drainage.)

4.3.1.1 Stainless Steel Spoon, Scoop, or Trowel

If necessary, the spoon, scoop, or trowel may be attached to an extension pole in order to reach the bottom of the catch basin, provided a representative sample can be retained on the spoon and recovered intact.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel spoon, scoop, or trowel:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a decontaminated stainless steel spoon, scoop, or trowel, collect an equal amount of material from five locations: each corner (or, if round, each compass point) and the center. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.

5. Place sampled solids into a decontaminated stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume, and mix to homogenize thoroughly using a decontaminated or disposable stainless steel spoon.
6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
10. Complete the chain-of-custody documents.

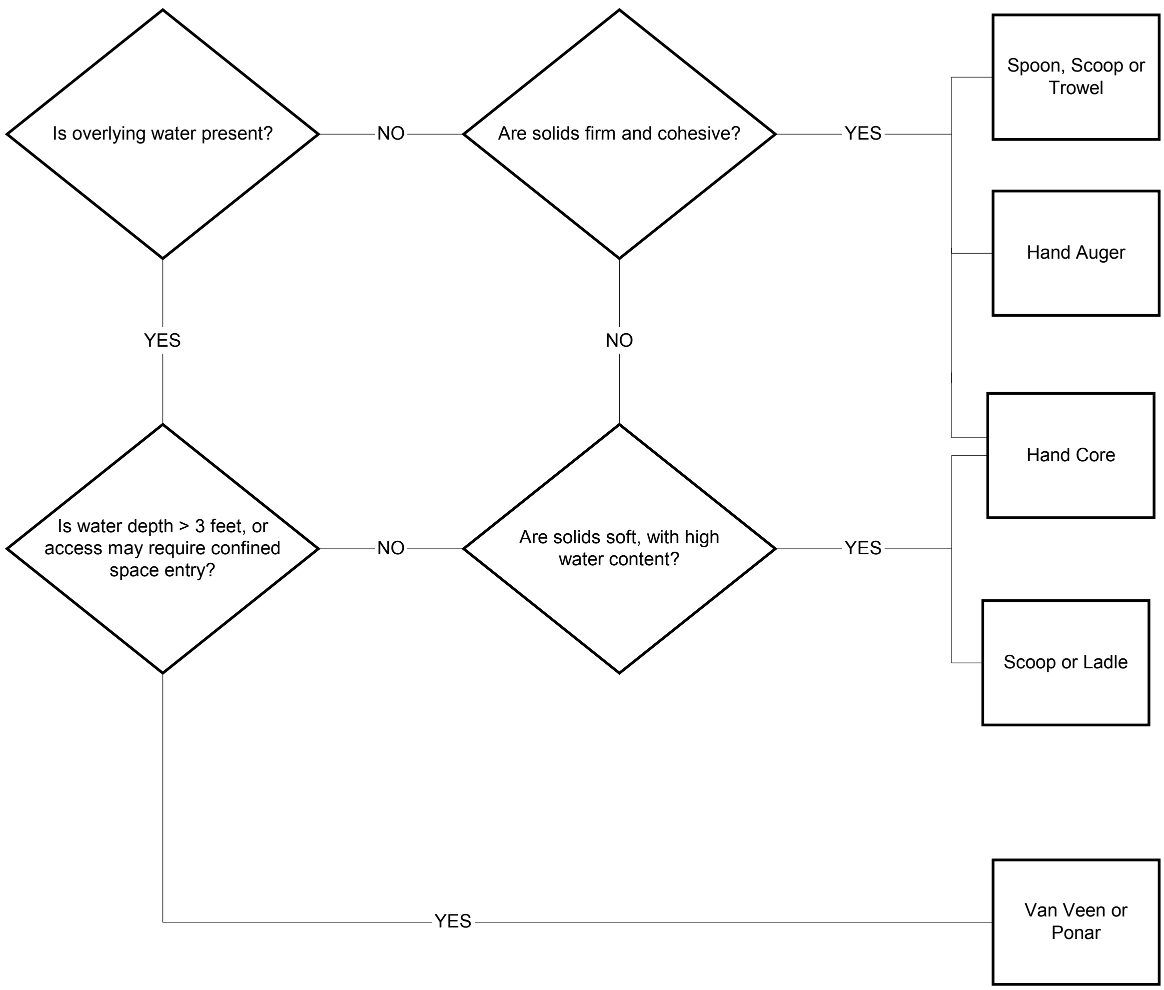
4.3.1.2 Stainless Steel Bucket Auger (Hand Auger)

Bucket augers are applicable to the same situations and materials as the spoon, scoop, and trowel method described above. Most bucket augers have long handles (> 4 feet), and some can be fitted with extension handles that will allow the collection of solids from deeper catch basins.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel bucket auger:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Advance a thoroughly cleaned and decontaminated bucket auger into catch basin solids in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.
5. Empty the auger into a stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume and mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place the sample into each appropriate sample container.

Figure 1. Flow Chart for Selecting the Appropriate Catch Basin Solids Sampler



7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
10. Complete the chain-of-custody documents.

4.3.2 Sampling Solids in Catch Basins with Standing Water

Hand corers or dredge samplers should be used when standing water is present in catch basins to prevent washout of sample material when the sampler is retrieved through the water column. Corers may also be used for dry and moist solids. Some hand corers can be fitted with extension handles that will allow the collection of samples in deeper basins.

4.3.2.1 Hand Corers

The following procedure defines steps to be taken when sampling saturated solids with a stainless steel hand corer:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated corer, advance the sampler into catch basin solids with a smooth, continuous motion, twist corer, and then withdraw it in a single motion.
5. Remove the nosepiece and withdraw the sample into a stainless steel bowl or tray.
6. Repeat steps 4 and 5 in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.
7. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
8. Collect a suitable portion of the mixed solids with the decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
9. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
10. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.

11. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.

12. Complete the chain-of-custody documents.

4.3.2.2 Clamshell-Type Dredge Samplers

Clamshell-type dredge samplers like the Petite Poner® and Van Veen® 0.025-m^2 dredge sampler are capable of sampling moist and wet solids, including those below standing water. However, penetration depths usually will not exceed several inches, so it may not be possible to collect a representative sample if the solids layer is greater than several inches. The sampling action of these devices causes agitation currents that may temporarily resuspend some settled solids. This disturbance can be minimized by lowering the sampler slowly and by allowing slow contact with the solids.

Samples collected with clamshell-type dredge samplers should meet the following acceptability criteria in order to ensure that representative samples have been collected (EPA, 2001):

- Solids do not extrude from the upper surface of the sampler.
- Overlying water is present in the sampler (indicating minimal leakage).
- Overlying water is clear and not excessively turbid.
- Desired depth of penetration has been achieved.
- The solids-water interface is intact and relatively flat, with no sign of channeling or sample washout.
- There is no evidence of sample loss.

The following procedure defines steps to be taken when sampling moist, wet, or submerged solids with a dredge sampler:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated dredge-type sampler and working on a clean, decontaminated surface, arrange the sampler in the open position, setting the trip bar so that the sampler remains open when lifted from the top.
5. Slowly lower the sampler to a point just above the solids surface.
6. Drop the sampler sharply into the solids, then pull sharply on the line, thus releasing the trip bar and closing the dredge.
7. Raise the sampler and place on a clean surface. Slowly decant or siphon any free liquid through the top of the sampler. Take care to ensure that fines are not lost in the process; if necessary, allow the sampler to sit and the fine particles to settle before decanting or siphoning free liquid.

8. Open the dredge and transfer the solids into a large stainless steel bowl or tray of sufficient size to receive three sample loads.
9. Repeat steps 4 through 8 in diagonal corners (or, if round, two opposite compass points) and the center of the catch basin. Material recovered at each point should be representative of the total depth of solids in the sampling device. If necessary, modify sampling points to correspond to catch basin size or dimensions. Record any deviations in the field notes.
10. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
11. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
12. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
13. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
14. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
15. Complete the chain-of-custody documents.

5.0 Sample Acceptability

Only solids that are collected correctly with grab or core sampling devices should be used for subsequent physicochemical testing. Acceptability of grabs can be ascertained by noting that the samplers are closed when retrieved, are relatively full of solids (but not overfilled), and do not appear to have lost surficial fines. Core samples are acceptable if the core was inserted vertically in the solids and an adequate depth was sampled without significant loss out the mouth of the corer.

6.0 Quality Assurance and Quality Control

A rinsate sample may be appropriate or required when non-disposable sampling equipment is used. The equipment rinsate should be collected between sampling locations and after the device has been decontaminated. The rinsate sample should be analyzed for the same parameters analyzed for in solids.

7.0 Resources

1. ASTM. September 1994. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediment for Toxicological Testing. American Society for Testing and Materials (E 1391-94). West Conshohocken, Pennsylvania.

2. EPA. 1987. A Compendium of Superfund Field Operations Methods, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response (EPA/540/P-87/001), Washington, D.C.

3. EPA. 2001. Methods for Collection, Storage, and Manipulation of Sediment for Chemical and Toxicological Analyses: Technical Manual. U.S. Environmental Protection Agency, Office of Water (EPA-823-B-01-002). Washington, D.C. October 2001.

Attachment D

WDOE Storm Water Sampling Guidance

Washington Department of Ecology 2005

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How To Do Stormwater Sampling
A guide for industrial facilities

Washington State
Department of Ecology

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WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Table of Contents

Introduction

The purpose of this guide is to help those who operate facilities do their own sampling.

The *Industrial Stormwater General Permit* requires that your facility conduct at least quarterly visual monitoring and sampling of stormwater and report the sampling results to Ecology. These requirements are outlined in the permit under *Section S4. MONITORING REQUIREMENTS*. This guide supports the sampling portion of the general permit but does not substitute for it.

The purpose of this guide is to help those who operate facilities do their own sampling by more fully describing the steps and procedures to be followed. This guidance will lead you to be able to sample in a way that will provide you and Ecology with meaningful results.

Sources of pollutants that may enter surface water, sediments, or ground water can be identified by sampling stormwater discharges. The results of sampling will be helpful when developing your Stormwater Pollution Prevention Plan (SWPPP), determining if your existing plan is adequate, and when implementing or assessing Best Management Practices (BMPs).

Some effort is required up front to prepare for sampling in a way that will meet requirements and provide useful data. What follows is a step-by-step procedure of what you need to do to gather and report data that will represent the quality of stormwater leaving your facility. The steps are organized to guide you through the process from start to finish of stormwater sampling.

This guidance is an update to "How to do Stormwater Sampling" which was originally developed by Ecology's Environmental Assessment Program in 2002. The update was made in accordance with the modified The Industrial Stormwater General Permit which became effective in January 2005.

Advance Planning for Stormwater Sampling

Deciding What To Sample

Before beginning your sampling, you'll need to determine the specific pollutants (water quality parameters) you are required to sample and test for. Ecology has listed these parameters on your permit cover sheet. Your parameters are based on:

◆ the standard set of parameters for all facilities,

◆ your facility's primary Standard Industrial Code (SIC Code),

◆ whether your facility discharges to an impaired (303 (d) listed) water body, and

◆ any requirements that apply to water cleanup plans (TMDLs).

All facilities must monitor for turbidity, pH, zinc, and oil and grease. Oil and grease are grouped together as a single parameter tested in the lab with a single analysis. Turbidity can be measured directly in the field using a handheld meter, or sampled and analyzed in the lab. pH must be measured in the field using either a calibrated pH meter or pH paper. You can get pH paper from a distributor of scientific/laboratory supplies or through the same laboratory that will be doing your sample analysis. Zinc, oil and grease and other parameters required by the permit (other than turbidity and pH) are measured by sending bottled samples to a laboratory for analysis.

Selecting a Laboratory to Test Your Sample

Having identified the parameters you will need tested, the next step is to select a laboratory to perform the tests. You are required to select a lab accredited by Ecology. Accreditation assures Ecology that the lab is able to do quality testing using the analytical methods specified under Monitoring Requirements in your permit. A list of labs can be found on Ecology's website: www.ecy.wa.gov/programs/eap/labs/lablist.htm.

Contacting the Lab in Advance

You should contact the lab well ahead of time. They will be providing you with the sampling bottles you'll need. For some water quality parameters, such as oil and grease, it is not only desirable but necessary to collect the sample directly into a specially-cleaned container, so you will need to have bottles from the lab on hand before you sample. You can also ask your lab to send pH paper along with your sample bottles.

Discuss with the lab the analytical methods they will use, as specified in the sample parameter tables included in S4. D of the general permit. The lab will provide you helpful information and explanations that go beyond the scope of this guide. If you must meet discharge limits listed in S3, Discharge Limitations, you should carefully review them with the lab.

All facilities must monitor for turbidity, pH, zinc, and oil and grease.

Contact the lab well ahead of time.

Ask questions - your lab can help you.

Issues you may want to cover with the lab include:

The type and size of bottle that will be supplied for each water quality parameter to be sampled and tested.

How full to fill the bottle.

Any safety concerns with materials supplied by the lab.

What you need to know about preserving your samples: Make a note of the parameters for which bottles will have preservative inside. For some tests, a preservative is necessary. The preservative is a substance that stabilizes certain chemicals at the time of sampling so that a valid test can be done later. It is critical that you use the correct bottles because tests requiring preservative will not be valid without the correct preservative. In some cases, the wrong preservative will interfere with a test. It is important not to lose the preservative that comes in the bottles supplied by the lab.

The kind of labels the lab will supply for the bottles and how the labels should be filled out. The labels or tags you use to identify the samples you take must be waterproof, and if you write on them, the writing must be waterproof also.

Typical Sampling Information

Parameter	Bottle Type	Minimum Sample Required	Holding Time	Preservation
Turbidity	500 mL wide-mouthed poly	100 mL	48 hours	Cool to 4º C
Total Zinc	1liter (L) bottle cleaned according to protocol	500 mL	6 months	HNO_3 to pH<2 Cool to 4º C
Oil and Grease	1L glass jar	750 mL (jar ¾ full)	28 days Jar preserved in lab within 24 hours of arrival to lab.	HCl to pH<2 Cool to 4º C

A description of forms or other paperwork to submit to the lab with the samples and how to fill them out.

Whether the lab will supply pH paper as well as sample bottles, tags or labels for the bottles, and blank forms.

How bottles and other supplies from the lab will be delivered to you.

The holding times for each water quality parameter to be sampled and tested. A holding time is the maximum time allowed between taking the sample and doing the lab analysis. If you exceed holding time, the sample analysis is not acceptable.

How and when you will deliver samples to the lab. Plan with the lab how you will get the samples to them in time to begin analysis before the parameter with the shortest holding time reaches that holding time. The fastest way to deliver samples to the lab may be to do so in person, but it may be possible to ship samples (cooled in picnic coolers) and still meet holding times. If you deliver samples in person, you can pick up bottles and supplies for the next quarter at the same time.

The table (left) shows typical sampling information for the three water quality parameters that must be monitored under the Industrial Stormwater General Permit. The information you obtain from your lab may differ somewhat from this:

In many cases, the preservatives listed above come pre-measured in the sampling bottles and there is no need to check pH. Ask your lab about this.

Sampling requirements tend to use scientific words and units of measure. Temperature is measured in degrees Celsius, "C". Thermometers that we typically use in the United States measure temperature in Fahrenheit, "F" and 4º C is about 39° F. But for your purposes, "Cooling to 4º C" means putting the samples on crushed ice or packed with blue ice in an ice chest so they will be kept just above freezing. Metric units are used to measure weight, volume and distance. Liquid volumes do not use "quarts" and "cups" but use measures such as liters, "L" and milliliters "mL". Chemicals use their own scientific notation. Nitric acid for example is HNO_3. Be sure to have the lab explain any words or expressions that you do not understand.

Deciding How You Will Take The Sample

Section S4.A.1 of the Industrial Stormwater General Permit states that a grab, time-proportionate, or flow proportionate sample may be taken. A grab sample is a single sample "grabbed" by filling up a container, either by hand or with the container attached to a pole. It is the simplest type of sample to collect and it is expected that most Permit holders will choose to collect grab samples. The general permit recommends that grab samples be collected within the first hour after stormwater discharge begins.

As we will discuss in the next section, oil and grease samples *must* be collected as grab samples. Some Permit holders may choose to better represent water quality parameters other than oil and grease by collecting time-proportionate or flow-proportionate samples. These samples consist of a number of subsamples taken at intervals rather than a single grab sample. The general permit recommends that time-proportionate and flow-proportionate samples be started within the first 30 minutes after discharge begins, and be taken over a two-hour period.

A time-proportionate sample is one made up of a number of small samples (subsamples) of equal volume collected at regular time intervals combined into a single large sample. A flow-proportionate sample is one made up of a number of subsamples where each subsample is collected in such a way as to represent a given amount of stormwater discharge. Time-proportionate and flow-proportionate samples provide the advantage of including a number of smaller samples (subsamples) in the sample so that the stormwater discharge is better represented than with a grab sample. Time-proportionate and flow proportionate samples can be collected either by hand or with automated equipment. Collecting them by hand is somewhat difficult and collecting them with automated equipment involves additional expenses. Additionally, flow-proportionate sampling requires some knowledge of how to measure fluid flow. A reference for automatic stormwater sampling is the book *Automatic Stormwater Sampling Made Easy* (Thrush and De Leon, 1993) published by the Water Environment Federation. It can be purchased at www.wef.org.

Collecting Oil and Grease Samples

The general permit requires that oil and grease samples be collected by all permit holders. Because of the particular way oil and grease samples must be collected, this requirement may govern your overall approach to sampling.

For some parameters other than oil and grease, it is possible to sample in difficult situations by filling a container and transferring it to the sample bottle to be sent to the lab. Oil and grease samples, however, must be collected from the stormwater source directly. The sample cannot be transferred from another container because oil and grease tends to stick to the inside surfaces of containers. Since you must sample directly into the oil and grease bottle (grab sample), taking grab samples may be the easiest way to collect additional samples for the other parameters. Take samples by collecting stormwater directly from the discharge into the bottles supplied by the lab, filling each bottle one after another.

Oil and grease samples must be collected directly into the bottle you send to the lab.

Because oil and grease samples cannot be transferred between containers, a sample cannot be formed from separate grab samples combined together. If more than one oil and grease sample is desired from a sampling site during a storm event, additional oil and grease grab samples must be collected and analyzed separately.

Because oil and grease samples must be collected directly and not through the tubing of an automatic sampler, those using automatic samplers will still have to grab oil and grease samples by hand.

Determining which Discharges to Sample

The first step in selecting sampling points is to consider the areas draining your facility. The site map in your SWPPP should show the drainage areas. Areas of particular concern are those where raw materials or finished product are exposed to rainfall and/or runoff, and areas where leaking fluids such as petroleum products and hydraulic fluids have the potential to enter stormwater runoff.

The next step is to determine where the runoff from each drainage area is discharged from your facility. If there are separate drainage areas with separate discharge points, stormwater sampled at one discharge sampling point may not represent the facility's stormwater quality overall.

Section S4.A.5 of the Industrial Stormwater General Permit describes the requirements for selecting sampling points:

"Sampling must be conducted to capture stormwater with the greatest exposure to significant sources of pollution. Each distinct point of discharge offsite must be sampled and analyzed separately if activities and site conditions that may pollute the stormwater are likely to result in discharges that will significantly vary in the concentration or type of pollutants. Where pollutant types do not vary, the Permittee may sample only the discharge point with the highest concentration of pollutants. However, the SWPPP must include documentation on how these determinations were made and in the description of each point of discharge, including the relative quantity (volume) of discharge and pollutants likely to be found."

If your facility discharges stormwater collected over areas that are used for similar activities and have similar site conditions, and there is reason to believe pollutant types will be similar in such areas, a single sampling point can be used to represent several discharge points. For example, if a facility has separate discharge points but the industrial activities are similar, you can sample at just one of the discharge points. The site chosen must be the one where there is reason to believe the pollutant concentration is highest (the worst case). For example, select the discharge that drains an area with greater use and/or more equipment activity. Determining where to sample can be approached as a logical deduction, or you may want to take samples at multiple sites and use the results to determine sampling location. Documentation of how sampling sites were chosen is required in the SWPPP, as described above in the general permit.

If your facility has multiple discharge points from areas with different uses or activities, you need to determine if that will result in significant differences in the type of pollutants that may be discharged. For example, if one portion of the site is used to store raw materials and discharges separately from another portion of the site where finished product is stored, it may be necessary to take separate samples. Some initial sampling and analysis may be necessary to make this determination. Ecology expects that most facilities will be able to choose a single sample location for their site.

Making a determination of whether a discharge is likely to have stormwater quality that differs from other discharges and require separate sampling requires a review of the site map in the SWPPP with consideration to sources of pollutants in each drainage area. This should be followed up with an on site assessment of activities, sources and quantities of pollutants in each drainage area. This information will help you document your decision as to whether two or more drainage areas can be represented by a single sample site.

Selecting Sampling Points

◆ Pipes discharging your facility's stormwater offsite.

◆ Ditches carrying your facility's stormwater offsite.

◆ Manhole access to storm sewer's carrying your facility's stormwater, so you can lower a sample bottle attached to a pole into the manhole. In general, manhole access on your property may be simpler and safer than access off property and more readily verifiable as carrying only your facility's stormwater.

These three types of sampling points are not too difficult to access and the flow within them tends to be fast enough, with enough turbulence, to allow you to collect well mixed, representative samples. In some cases, portions of industrial stormwater runoff leave a site as sheet flow. Specific approaches to sampling of pipes, ditches, manholes, grated storm drains, and sheet flow will be covered in the final section of this guide manual.

Make sure your sampling points will provide for sampling only the stormwater that comes from your facility. If the stormwater in a pipe (storm sewer) contains other discharges, move your sampling point upstream to a point where the flow is from your facility only. Also check to see that there is no base flow in the storm sewer during dry periods. Report in your SWPPP the presence of any base flow and measure or estimate its flow rate. If it is not possible to sample only flow from your facility, document the reason for this and provide information concerning the source of the flow you are sampling.

If possible, the stormwater your facility samples should not be a mixture of your facility's stormwater with other water. Some examples of situations where a sample would be of a mixture of water sources, situations in which you should **not** sample:

Examples of mixed water sources situations in which you should not sample:

A ditch that carries additional stormwater from properties upstream. In this case, the stormwater from your facility is mixed with other water and you should find a location or locations where your facility's stormwater alone can be sampled.

A stormwater sewer or pipe (culvert) discharges to a creek or other receiving water, the pipe being partially submerged where it discharges into the receiving water. In this case, this final discharge point will not be able to be used as a sampling point because the stormwater flow is mixed with the receiving water.

A manhole that carries stormwater, not only from your facility but from other stormwater sources as well. If you are grabbing a sample from a manhole but from the point where a storm sewer from your facility ends at a municipal manhole, make sure that the flow in that pipe is entirely from your facility, that the pipe is not submerged or partly submerged and that you are otherwise not prevented from collecting stormwater from your facility only. If you are not sure that a storm sewer carries only flow from your facility, the municipality may

Base flow here refers to any water in the ditch that is not a direct result of stormwater runoff. Ground water seepage into the ditch, for example, would add base flow.

*Manhole access can be a good sample point if it can be accessed safely and the stormwater is solely from your facility. Do **not** climb into the manhole. Use a sample bottle attached to a pole to take the sample.*

have storm sewer plans to help you determine this. Contact the municipality beforehand to discuss sampling from the manhole and associated safety issues, particularly for manholes in areas with vehicular traffic.

Practice sampling before you do the real thing.

It is important to sample flow from only your facility if possible because otherwise it cannot be determined what the sample actually represents. If you discharge stormwater to a stormwater conveyance system that includes stormwater from other sources, you need to sample before your stormwater commingles with stormwater from other sources. However, if stormwater runs onto your property in an uncontrolled fashion (for example, sheet flow) from adjacent property, into areas of industrial activity on your site so that it becomes a part of the stormwater discharge from your site, this should be included in your sample of stormwater discharge. If you are concerned about this offsite source, you may want to sample that stormwater where it enters your property. If the results show significant pollution, you may want to provide Ecology with a narrative description of the contributing site and sample results to document the relative contribution of the other property or upstream source.

Take time to get ready for sampling.

It is a good idea to observe the sampling point(s) you have chosen during actual stormwater runoff conditions to see how readily stormwater can be sampled there. Keep in mind that changing tides and flow conditions in receiving waters, including flood stages may occur during storm events. This may cause a pipe that is discharging your facility's stormwater to become submerged or partly submerged, preventing you from sampling during some conditions.

Obtaining Supplies for Sampling

The supplies you will want to have on hand before sampling include:

◆ Sampling bottles from the lab, including a few extra of each type.

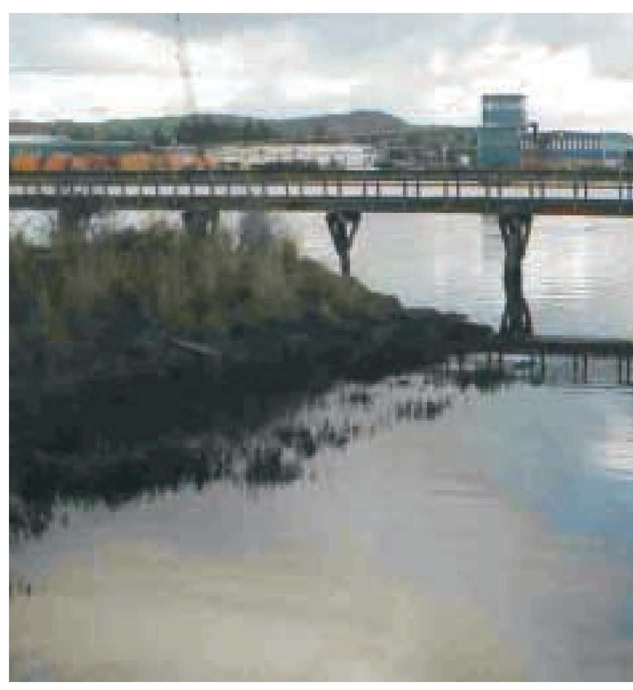
◆ When needed, a pole to hold sample bottles and filament strapping tape.

◆ Powder-free disposable nitrile or latex gloves (sold by medical and laboratory suppliers). Do not use powdered gloves as the powder may contain metals that could contaminate metals samples such as zinc.

◆ Foul-weather gear.

◆ One or more picnic coolers (depending on the number of samples to be stored and transported or shipped).

◆ A bound notebook to serve as a field book for keeping records concerning sampling. Notebooks with waterproof pages are available for these field notes at office supply stores. The information to be included in the notes will be described in the "Keeping Records" section of this guide.



Planning Just Prior to Stormwater Sampling

Now that the bulk of the planning for sampling is complete, there are a few things to keep in mind before deciding to actually begin sampling.

Being Prepared

It is important to assemble everything that will be needed for the sampling event ahead of time because opportunities to sample during storm events often come with little advanced notice. Complete the identification tags and Lab Services Required form. Place the tags, lab form, field notebook, permanent ink pen, meter, and pH paper in the cooler with the sample bottles. Have re-sealable plastic bags or other means on hand to keep the pH paper dry. If you are using a turbidity meter or pH meter, be prepared to protect them from the rain. Have foul-weather gear ready and available. It will be necessary to keep sufficient ice on-site or plan to purchase ice that day.

Choosing the Storm Event

Now you are ready to sample. Successful sampling is first and foremost a matter of being at the right storm event at the right time. What follows is some guidance on how to do that.

The general permit recommends that the storm event to be sampled must meet the following two conditions:

1. Be preceded by at least 24 hours of no greater than trace precipitation.

2. Have an intensity of at least 0.1 inches of rainfall (depth) of rain in a 24-hour period.

If the above criteria can't be met, the permittee must still collect and submit stormwater sampling results in accordance with the general permit. A permittee is required to sample only once in a sample collection period and use its best efforts to achieve the above recommended sample collection criteria. If a sample is taken and the recommended sample collection criteria are not met, the permittee is not required to conduct additional sampling for that sample collection period.

Success in collecting grab samples requires being ready to go as soon as the decision is made to sample during a particular storm event. It is especially important to be at-the-ready because the permit recommends that grab samples be collected during the first hour of stormwater discharge. Note that the permit recommends that the sample be taken within the first hour after discharge from your facility to a point off site, not from when rainfall begins.

You will increase your chances of meeting the second recommended criterion for rainfall intensity at a minimum of effort if you evaluate weather forecasts before deciding whether or not to sample a particular rain event.

Sample during a hard (intense) rain event.

Check weather forecasts.

If your facility is located in an area that is covered by a standing snow pack for days at a time during a year of normal precipitation, you may alternatively sample a snowmelt event during the winter or spring quarter. The recommended sampling conditions for a snowmelt event are as follows:

1. It is preceded by at least 24 hours of no greater than *trace* precipitation.

2. The snowmelt is generated by a rainfall or warm weather melt-producing event on a standing snow pack of at least one inch in depth.

3. The sample is collected during the first hour of discharge from your facility that was produced by the melting snow.

Keeping up with the weather forecast and planning so that sampling can be carried out on short notice are the keys to successful sampling.

Local forecasts, including televised satellite and radar images can give an indication of the expected intensity of coming storms. The National Weather Service is an excellent source of information on upcoming storms. It also includes local current radar and satellite images. Their website: *http://www.wrh.noaa.gov/seattle.* A number of commercial websites, such as *http://www.weather.com/* and *Yahoo* also provide weather information and forecasts.

When evaluating a weather forecast, consider indications of expected intensity, for example "90% chance" rather than "50% chance" and "rain" rather than "showers." Over the telephone, National Weather Service personnel can often provide estimates of anticipated rainfall amounts. In addition to intensity, consider the predicted duration of the storm. It will be very helpful to spend time observing rain events at your site with attention to how rain intensity relates to stormwater discharges from your site, before you begin sampling.

Once the decision has been made to attempt to sample a storm event, the personnel who will be sampling should be notified and they should prepare to sample. If it does rain, they should be at the sampling sites before stormwater begins discharging so they can document the time of discharge and be ready to sample.

Conducting Sampling at Your Facility

After you have selected a storm event and it begins raining, the personnel conducting the sampling should prepare their equipment and go to the sampling site(s). They will be collecting grab samples at the sampling site(s), placing the samples in picnic coolers containing ice, and keeping notes in a field book.

Sampling for the first time may require working out some difficulties, but after performing these duties once, future sampling will not be difficult.

Checklist for Sampling

Because stormwater sampling is not a daily part of the workload of a facility, it is a good idea to keep a checklist of things to have prepared before sampling and to do during sampling. You can make the checklist by jotting down the things you did for the first sampling event to remember for subsequent sampling events. Update this checklist, if necessary, based on the experience you gain with each sampling event.

How to Fill Sample Bottles

This section and an illustrated appendix at the end of this guide describe how to collect a sample properly. Collecting a grab sample can be as simple as holding a bottle under the stormwater falling from a pipe and filling the bottle properly. Still, the person doing the sampling must use care in applying the principles outlined below so that the sample will be representative of the water being sampled.

Simple principles of good grab sample collection:

Wear disposable powder-free gloves when sampling.

Grab samples with the stormwater entering directly into bottles supplied by your lab rather than by transferring the samples from a container that may not be clean. Metal contamination of ordinary containers is common and household detergents often contain phosphorus, a tested parameter for some industries. Again, transferring the sample from another container is not an option for oil and grease samples under any circumstances.

When holding the sample bottle your lab has provided, keep your hands away from the opening in order to prevent contaminating the sample.

Always hold the bottle with its opening facing upstream (into the flow of water) so that the water enters directly into the bottle and does not first flow over the bottle or your hands.

Sample where the water has a moderate flow and, if possible, some turbulence, so that the stormwater discharge will be well-mixed and the sample will be representative. Sampling in still water should be avoided. Include in your field book a note about the sample location and how briskly the water appears to be moving.

Sample from a central portion of the stormwater flow, avoiding touching the bottom of channels or pipes so as not to stir up solid particles.

Have your sampling kit ready to go.

Take notes! Writing down your observations at the time of sampling is importatnt.

Do not rinse or overfill the bottles. The bottles supplied by your lab for some parameters (ammonia and phosphorus) will include small amounts of liquid preservative (generally a few drops). Fill the bottle to about ½ inch of the top (not quite full) to ensure that no preservative is lost.

As soon as the sample is collected, cap the bottle and label it. It is important that the bottles are labeled correctly so that the lab will be able to identify samples by sample site and ensure proper preservation for each parameter. It is a good idea to place sample bottles in re-closable bags. Place the samples in a picnic cooler partially filled with ice. Plan to maintain ice in the picnic cooler until the samples arrive at the lab. Remember to make certain that the samples will be delivered to the lab soon enough for the lab to meet holding times.

Oil and grease sampling raises additional concerns:

Oil and grease floats on water so sampling it requires special attention. Oil and grease samples must be collected directly into the sample bottles supplied by the lab because oil and grease tends to stick to the sides of containers. Do not rinse the sampling bottles beforehand or pour the sample from another container. Do not fill the bottle completely and do not pour out some of the sample if the bottle is overfilled by mistake. If you do overfill a bottle, use a new bottle instead to collect your sample. Because you only get one try at filling an oil and grease bottle, it is a good idea to have plenty of extra bottles on hand.

Oil and grease samples should be collected as the stormwater falls from a pipe or from a running, turbulent stream of flow when possible so the source will be well mixed. When the samples must be collected from a water surface, the person holding the bottle should plunge it below the surface in a sweeping arc and then bring it upwards through the water surface again, so the water surface is broken twice by the mouth of the bottle. Be sure to note in your field book how you collected your samples as this is especially important for the oil and grease sample.

Keeping Records

Section S5. of the general permit specifies requirements for reporting and recordkeeping. In order to comply with the requirement that lab reports include sampling date and sampling location, you will need to supply this information to the lab when submitting samples. You can do this by using the sample location as the field station identification on your labels or sample tags.

You should purchase a notebook for use in the field. Water resistant "rite in the rain" notebooks serve the purpose well. Information is available at www.riteintherain.com.

Section S5.C. requires that you record the date, exact place, method, and time of sampling or measurement, and the individual who performed the sampling or measurement (the section also specifies some requirements for lab record keeping). Record these in your field book:

- ◆ Time rainfall began
- ◆ Sampling location (when there is more than one)
- ◆ Date of sampling
- ◆ Time of sampling (and time you completed sampling if different)
- ◆ How you collected the sample (for example, "from a ditch by hand" or "from a manhole with the bottles on a pole")
- ◆ name of the sampler(s)
- ◆ number, types (parameters) of samples collected

◆ field measurement results (such as pH)

◆ unusual circumstances that may affect the sample results.

Entries in the field book should be made with ink. If you make an error in the field book, cross it out rather than whiting out or erasing. Number the pages of the field book consecutively. To ensure that the bound field book is a complete record, do not rip out pages from it.

It is desirable in addition, though not required by the general permit, to record the following information for each storm event sampled:

◆ number of dry days before the day the sample was collected, or a statement that there was at least one day of no greater than trace precipitation before sampling.

◆ inches of rain during a 24-hour period

◆ time of sampling as well as date

◆ date and time the rainfall began

◆ date and time the discharge began at the sampling site

◆ duration of the storm in hours

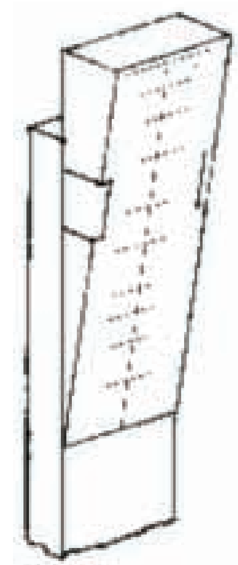
◆ inches of rainfall during the storm

The information you record for the first two items above (number of preceding days of no greater than trace precipitation and inches of rain during a 24-hour period) will serve to document that you met those recommended criteria for sampling specified in the general permit.

Determining if the Sampled Storm Event Met the Recommended Criteria

Section S4.A. recommends that the storm event be preceded by at least 24-hours of no greater than trace precipitation. During times of clear weather, it may be obvious that this criterion has been met. When it is cloudy, you can verify that there has been no precipitation (including overnight) by installing a simple, inexpensive rain gauge at your site.

The same section of the permit also recommends that the storm have a rainfall intensity of at least 0.1 inches of rain in a 24-hour period. This does not mean that the rainfall must last for a full 24 hours, only that from the time it begins raining to the time you stop sampling, the rainfall be of the recommended intensity or greater. To determine this, you should observe and record the time it began raining as well as the time you stopped sampling. What the storm does after you stop sampling is of no concern. In addition to the times rainfall began and sampling ended, your rain gauge will give you all of the information you need to easily calculate the rainfall intensity.



A simple, inexpensive rain gauge mounted on a post. A rain gauge such as this one provides accurate readings at the low rainfalls often associated with the period from the beginning of rainfall to the end of sampling. The gauge can be removed and the water that has collected in it dumped out between rains.

An example rainfall intensity calculation:

Rainfall begins at 9:35 AM (you empty the rain gauge beforehand)

Stormwater discharge at your sampling site begins at 10:05

You complete sampling at 10:30

Your rain gauge shows 0.01 inches of rain when you stop sampling

Rain intensity
= 0.01 inches / 55 minutes
= 0.00018 inches/minute
= 0.00018 inches/minute
x 60 min/hr
x 24 hrs/24 hrs
= 0.26 inches/ 24 hours

The criterion for rain intensity is 0.1 inches / 24 hours. 0.26 is greater than 0.1, so the storm event you sampled meets the recommended criterion.

Get the best sample you can.

If you do not have a rain gauge, you will have to rely on rainfall data from other sources. The National Oceanographic and Atmospheric Administration (NOAA) posts daily rainfall records on their website: *http://www.wrcc.dri.edu/state_climate.html.* (Note that there is an underline between "state" and "climate," but no space, in this web address). The data posted is only for the previous day, so you will have to make sure you don't miss the internet posting. A disadvantage of relying on this data is that it is a measure of nearby rainfall but not that from your site. A further disadvantage is that it gives you only daily (24-hour) rainfall data and, while this may indicate a rainfall of less than 0.1 inches in some cases, you may have had sufficient rainfall intensity at your site to meet the recommended criterion of the general permit, had you measured it with a rain gauge.

When the Sampled Storm Doesn't Meet the Recommended Criteria

There may be times when you start to sample but the rainfall intensity turns out not to meet the recommended criterion of the general permit. Or despite your best efforts, you are unable to collect grab samples during the first hour of a storm event that meets the recommended criterion for preceding dry conditions. When this happens, the general permit states that the permittee must still collect and submit stormwater sampling result, and must include an explanation with the monitoring report identifying what recommended criteria were not met and why.

Special Sampling Considerations

Safety should be the primary consideration in sampling. Samples should never be collected in a way that compromises the safety of the sampler. In cases where a physical hazard such as a trip hazard or when sampling near deep water bodies, samplers should work in pairs. Do not wade in water where the estimated depth in feet times the velocity in feet per second is equal to or greater than 8, as swift currents can lead to drowning accidents. Be aware of the slip hazard common near the banks of water bodies and decide whether a bank is too steep to negotiate safely. Safety comes down to individual judgment. Never put yourself in a position you consider to be unsafe.

Collecting grab samples of stormwater is basically a simple process but an important one since getting good results depends on proper sampling. Samples can be collected easily in some locations, but not all stormwater discharges are as readily sampled as the flow in a ditch or from a pipe falling into a receiving water. Below are some situations you may encounter and suggested approaches for handling them. Because oil and grease samples must be collected directly into the bottle supplied by the lab we will consider only methods for collecting samples directly by hand or with a bottle attached to a pole. When sampling in these or other situations, keep in mind the steps outlined in the section, *How to Fill Sample Bottles*.

Sampling as Stormwater Discharges from a Pipe into a Receiving Water

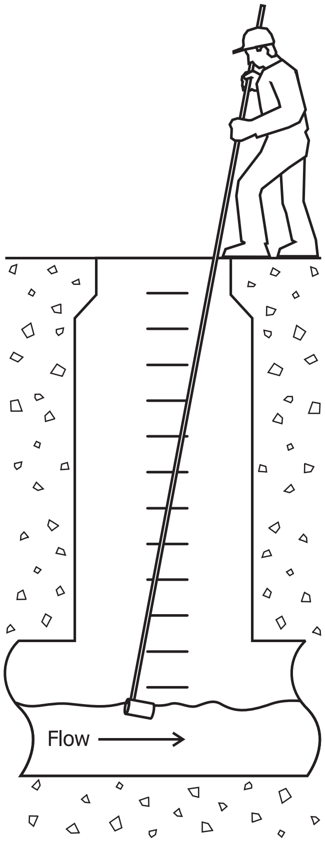
If stormwater is being discharged from your facility through a pipe into a ditch, creek, or other receiving water, it can be readily sampled as it falls from the pipe before it reaches the receiving water if the discharge pipe is safely accessible and not submerged. Hold the bottles with the bottle opening facing upstream (into the flow and be sure not to overfill them. You may need to fasten the collection bottles to a pole to reach the pipe. Attaching a bottle to a pole is described in the section below, *Sampling from a Manhole*.

Sampling from a Manhole

When sampling from the manhole of a municipal storm sewer, remember to contact the municipality beforehand. Discuss sampling being sure to cover safety concerns. Open a manhole with a hook or pick axe, exercising care not to drop the manhole cover on hands or feet. **You should not, under any circumstances, enter the manhole unless trained to safely enter confined spaces**, but you can sample the flow in a manhole from above ground by taping the sampling bottles, one at a time, to a pole and lowering the pole into the manhole.

Each bottle can be fastened to the pole by holding the bottle against it and wrapping tape tightly around the bottom and the top of the bottle as you hold the bottle firmly to the pole. Filament strapping tape works well for this purpose as it is waterproof and strong. If the flow in the storm sewer is shallow, the bottle may have to be positioned horizontally with the bottle's opening somewhat higher than its bottom. When sampling in a manhole, be

Don't take risks - know how to sample safely.



When sampling from a manhole, use a pole to safely sample from above ground. Avoid touching the sides of the manhole or pipes with the bottle to prevent contamination. Place the opening of the bottle upstream so that the flow enters the bottle directly.

careful not to scrape the bottle against the sides of the pipe to avoid picking up extras solids in your sample.

Collecting into bottles with oil and grease samples with a pole is done by plunging the bottle on the pole below the water surface and back upwards. This must be done as a single motion and only once. Because you only get one try at getting a good oil and grease grab sample, it may take some practice and extra bottles to collect the amount of sample you need without overfilling the bottle. Collecting samples other than oil and grease into bottles with preservative can be done by quickly plunging the pole into the flow repeating if necessary until the bottle is most but not all of the way full. If you overfill the bottle, remove it, tape a clean bottle to the pole, and try again. Be sure, when collecting samples with a pole, to follow clean principles by keeping the pole downstream of the bottle while sampling.

Sampling from a Drainage Ditch or Swale

If a drainage ditch carries stormwater flow from your facility offsite, and if it carries no flow other than the flow from your facility, you can sample the water in the ditch simply by placing the bottle where the flow is free, with the bottle opening facing upstream. If you cannot reach a freely flowing portion of the ditch by hand, you may need to attach the bottles, one at a time, to a pole for sampling. Follow the procedure outlined in the section, *How to Fill Sample Bottles*.

If the flow is carried in a small ditch or swale, you can install a barrier device in the channel or deepen a small area so you can gain enough depth of flow to sample directly into the bottles. Make sure to allow for sufficient time after disturbing the bottom so that the solids resulting from muddying the water will not become part of your sample.

Sampling Sheet Flow

It is not always possible to sample stormwater runoff in locations such as ditches or pipes where the flow is concentrated. Sometimes the permittee has no choice but to select sample locations for which sheet flow is sampled before it becomes concentrated. Approaches to sampling sheet flow are described below and illustrated in the figures that follow.

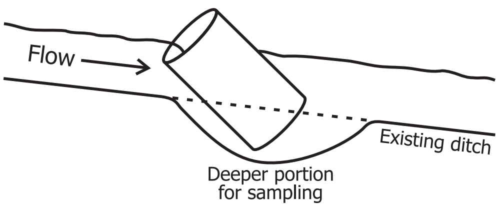
In some cases, a stormwater discharge from a facility is not concentrated at any point and leaves the property in the form of sheet flow as it runs off a work area or driveway or grassy area. In this case the flow may be too shallow for the collection bottle to be filled with sample. It is often possible to find a way to collect the stormwater runoff in these situations.

One way to concentrate sheet flow is to excavate a small basin in an existing ditch or other location where stormwater runoff flows. Another approach is to install a barrier device or trough, gutter, or ditch to intercept and concentrate stormwater flow. As with other sample sites, the flow should be moving and somewhat turbulent so the samples will be well-mixed. Be sure that any excavation you do does not expose the stormwater to be sampled to newly worked soil surfaces that the runoff may erode, increasing the solids in your samples. You may want to consider lining the trough, gutter, or ditch with plastic. Be sure not to introduce materials (such as metals that include zinc) that may contaminate the samples. Sheet flow on paved areas can be concentrated and collected by constructing small bumps, similar to speed bumps.

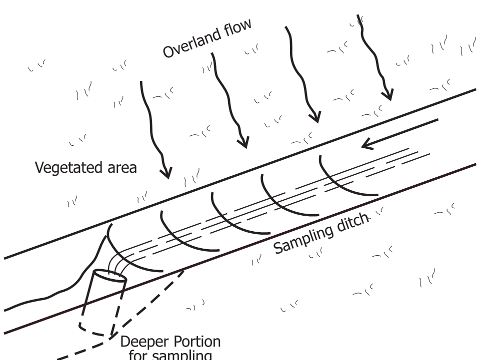
Another way to collect samples from sheet flow is to use a special peristaltic hand pump to pump samples from shallow surface flows. This method is of limited use for collecting the samples required by the general permit as it cannot be used to collect oil and grease samples.

Roger Bannerman of the Wisconsin Department of Natural Resources has developed simple devices to grab samples of sheet flow from paved areas, rooftops, and lawns. Though the devices are intended to be used for simple, automatic sampling, pouring a container of collected sample into other sample bottles, the ways in which they intercept and concentrate flows can be adopted for direct grab sampling.

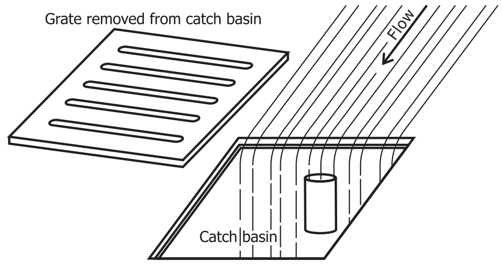
The following figures illustrate the methods of sampling sheet flow discussed above:



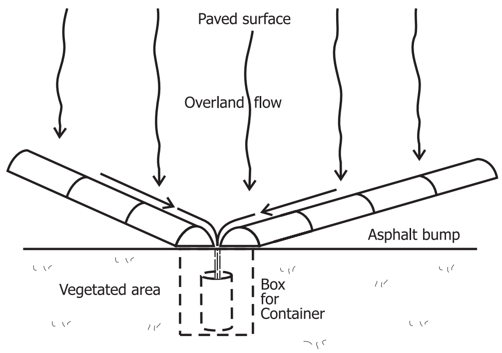
Deepening an existing ditch can allow samples to be collected directly into bottles in some cases. Be careful not to stir up solids from the sides or bottom of the ditch.



Runoff entering a catch basin can sometimes be collected directly into bottles by removing the grate and allowing the runoff to fall into the bottles.



Overland flow from vegetated areas can be sampled by constructing a shallow ditch to intercept the runoff and a deepened area to place bottles to catch the runoff.



Overland flow on paved areas can be sampled by constructing asphalt or concrete bumps to collect and concentrate the flow. A box positioned below ground surface in the paved area or the edge of an unpaved area can provide a place to collect samples directly into bottles.

Sampling from a Stormwater Detention Pond or other BMP

When stormwater from a facility discharges after flowing through a detention pond or other treatment system, sample as the stormwater flows out at the discharge point. Ponds may hold stormwater for a time before discharge begins. Sample within the first hour, preferably 30 minutes from when the pond begins to discharge.

Ecology Wants to Hear from You

If you have suggestions on how Ecology can improve this guidance document, have developed innovative sampling techniques, or just want to comment on stormwater sampling, please contact

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Appendix - Proper and Improper Methods of Sampling

Do not *touch openings of bottles. Keep bottles clean to prevent contamination.*

Do not *allow bottle lids to touch ground. Keep lids clean to prevent contamination.*

Do not *sample in stagnant areas with little flow.* **Do not** *stir up bottom sediments or allow foreign materials to enter the sample bottle. (***Do** *be careful to grab a clean sample in cases where stormwater runoff is shallow.) If the runoff is so shallow that it is not possible to sample without the sample being contaminated in the process, then find an alternative way to sample.*

Do *attach a bottle to a pole for sampling in manholes or when a hand sample would be in stagnant water. A boathook is used in this example and the bottle is attached to it with filament strapping tape.*

If the water is too shallow to sample with the bottle upright on the pole, try taping it on sideways, but tilted up slightly.

Do not *sample with the bottle opening facing downstream, when using a pole or sampling by hand. Water flowing past your container, pole, or hand and into the container can be contaminated by such contact.*

Do *sample with the opening of the bottle facing upstream, into the flow so the water will enter directly into the bottle. This is true when sampling either by hand or with a pole.* **Do** *sample water that is rapidly flowing rather than stagnant.*

Do not *allow water to overfill the bottle, particularly not for sample bottles with preservative. Oil and grease samples should be collected from water falling into the bottle when possible, or otherwise in a single swoop.*

Do *collect samples without overfilling the bottles.*

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